DRAFT ENVIRONMENTAL ASSESSMENT

KA‘ENA POINT ECOSYSTEM RESTORATION PROJECT

Wai‘anae and Waialua Districts
Island of O‘ahu

In accordance with
Chapter 343, Hawai‘i Revised Statutes

Proposed by:

Division of Forestry and Wildlife
Department of Land and Natural Resources
1151 Punchbowl Street, Ste. 325
Honolulu, Hawai‘i 96813
(808) 587-0166

December 2007

TABLE OF CONTENTS

I. SUMMARY

Project Name	Ka‘ena Point Ecosystem Restoration Project
Project Location	Ahupua‘a of Keawa‘ula and Ka‘ena Wai‘anae and Waialua Districts Island of O‘ahu TMKs 8-1-001-006; 8-1-001-022; 6-9-001-030; 6-9-002-004; 6-9-002-009; 6-9-002-013
Land Use Designations	Conservation District, Resource and Limited Subzones Special Management Area
Applicant	State of Hawai‘i Department of Land and Natural Resources Division of Forestry and Wildlife
Landowner	State of Hawai‘i
Approving Agency	State of Hawai‘i Department of Land and Natural Resources
Anticipated Determination	Finding of No Significant Impact
Agencies & Organizations Consulted	
Federal:	Federal Aviation Administration US Air Force, Ka‘ena Point Satellite Tracking Station US Army Garrison, Hawai‘i US Coast Guard, District 14, Office of Aids to Navigation USDA Animal and Plant Health Inspection Service, Wildlife Services USDA Natural Resources Conservation Service US Fish and Wildlife Service, Pacific Islands Office US Fish and Wildlife Service, O‘ahu National Wildlife Refuge Complex US Geological Survey, Biological Resources Discipline, Pacific Island Ecosystems Research Center NOAA Fisheries, Pacific Islands Regional Office, Protected Resources Division

	US Army Museum of Hawai‘i
State:	Department of Agriculture
	Department of Business, Economic Development, and Tourism, Office of Planning
	Department of Defense
	Department of Education
	Department of Hawaiian Home Lands
	Department of Health, Environmental Planning Office
	Department of Land and Natural Resources
	Division of Aquatic Resources
	Division of Conservation and Resources Enforcement
	Division of Forestry and Wildlife
	Division of Historic Preservation
	Division of State Parks
	Land Division
	Office of Conservation and Coastal Lands
	Public Information Office
	Department of Transportation, Airports Division
	Land Use Commission
	Natural Area Reserves Commission
	O‘ahu Island Burial Council
	Office of Environmental Quality Control
	Office of Hawaiian Affairs
	Office of Hawaiian Affairs: Native Hawaiian Historic Preservation Council
	University of Hawai‘i, Environmental Center
	University of Hawai‘i, Botany Department
	Senator Colleen Hanabusa
	Senator Robert Bunda
	Representative Michael Magaoay
	Representative Maile Shimabukuro
County of Honolulu:	Board of Water Supply
	Department of Planning and Permitting
	Office of the Mayor
	Councilmember Todd Apo
	Councilmember Donovan Dela Cruz
Other Organizations:	‘Ahahui Mālama I Ka Lōkahi
	Ahupua‘a Action Alliance
	American Bird Conservancy
	Bishop Museum, Hawai‘i Biological Survey
	Conservation Council for Hawai‘i

Earthjustice
Hawaiian Civic Club of Waialua
Hawaiian Civic Club of Wai‘anae
Hawaiian Railway Society
Hawai‘i Audubon Society
Hawai‘i Bicycling League
Hawai‘i Conservation Alliance
Hawai‘i’s Thousand Friends
Hawai‘i Trail and Mountain Club
Hawai‘i Fishing News
Historic Hawai‘i Foundation
Ho‘omau Ke Ola
Hui Mālama I Na Kupuna O Hawai‘i Nei
Hui Mālama o Mākua
‘Ike ‘Āina
‘Īlio‘ulaokalani Coalition
KAHEA – The Hawaiian-Environmental Alliance
Kai Makana
Kamehameha Schools
Kokua Hawai‘i Foundation
Life of the Land
Mālama Hawai‘i
Nani ‘O Wai‘anae
Native Hawaiian Legal Corporation
North Shore Environmental Coalition
North Shore Kupuna
North Shore Neighborhood Board
O‘ahu Game Fish Club
O‘ahu Invasive Species Committee
Pacific Islands Fisheries Group
Polynesian Voyaging Society
Sierra Club, Hawai‘i Chapter, O‘ahu Group
The Nature Conservancy of Hawai‘i
The Outdoor Circle
The Wildlife Society, Hawai‘i Chapter
Waialua Boat Club
Waialua Community Association
Wai‘anae Boat Fishing Club
Wai‘anae Coast Coalition
Wai‘anae Coast Neighborhood Board
YMCA of Honolulu, Camp Erdman Branch
John D. Bennett
Thomas T. Shirai, Jr.
Mary Ikagawa
Lara Reynolds
Cynthia Rezentes

Summary of Action

The Ka‘ena Point Ecosystem Restoration Project is the result of a partnership between the Department of Land and Natural Resources, Divisions of Forestry and Wildlife and State Parks, the U.S. Fish and Wildlife Service, and the Hawai‘i Chapter of The Wildlife Society. Ka‘ena Point Natural Area Reserve (NAR) hosts one of the largest seabird colonies in the main Hawaiian islands, contains several populations of endangered plants, and receives frequent visits by basking monk seals. Under current management, nesting seabirds and native plants are under constant threat from predatory animals; more than 100 ground-nesting seabirds were killed by dogs in 2006 despite on-going predator control activities. The proposed project involves the construction of predator-proof fencing (2 meters tall) to prevent feral predators such as dogs, cats, mongoose, and rats from entering into 59 acres of coastal habitat within Ka‘ena Point Natural Area Reserve. The exclusion and removal of these predatory animals is anticipated to result in an increase in the existing population of nesting seabirds, encourage new seabird species to nest at Ka‘ena Point, enhance regeneration of native plants, and benefit monk seals by reducing the risk of disease transmission. The Ka‘ena Point Ecosystem Restoration Project is expected to have primarily positive effects on the resources protected in the NAR. No significant adverse effects are anticipated with regard to the environment, archaeological features, cultural practices, viewplanes, or public access or use of this area during or after construction of the proposed fencing.

II. PROJECT PURPOSE AND NEED

In 1970, Hawai‘i became one of the first states in the country to recognize the importance of its unique natural resources by establishing the Natural Area Reserves System (NARS). The NARS were created to “...preserve in perpetuity specific land and water areas which support communities, as relatively unmodified as possible, of the natural flora and fauna, as well as geological sites, of Hawai‘i.” (Hawai‘i Revised Statutes § 195-1). The system presently consists of nineteen reserves on five islands, encompassing more than 109,000 acres.

Ka‘ena Point NAR was established in 1983, by Executive Order 3162, to protect a portion of the most extensive remnant dune system on O‘ahu from damage and degradation caused by off-road vehicle use, erosion, and the spread of invasive species. At the time the NAR was created, these factors had largely destroyed most of the native vegetation within the NAR, making it unsuitable for use by nesting seabirds. After the establishment of the NAR, vehicular access to most of the reserve was blocked, and recovery of native vegetation has been significant, with increasing numbers of endangered plants such as ‘ohai

(*Sesbania tomentosa*) and recovery of the rare coastal naupaka (*Scaevola sericea*) community.

As the coastal habitat has improved, and predator control has been initiated, increasing numbers of ‘ua‘u kani, or wedge-tailed shearwaters (*Puffinus pacificus*), and Laysan albatrosses, or mōlī (*Phoebastria immutabilis*), began to breed in the NAR. Wedge-tailed shearwater chicks hatching at Ka‘ena have increased in number from zero in 1995 to over 1,500 this year (2007). Laysan albatross alone have increased from zero pairs in 1989 to approximately 60 nesting pairs last year. The reserve also acts as refuge for the endangered Hawaiian monk seal or ‘īlioholoikauaua (*Monachus schauinslandi*), and honu or green sea turtles (*Chelonia mydas*), koholā or humpback whales (*Megaptera novaeangliae*), and nai‘a or spinner dolphins (*Stenella longirostris*) are often viewed just offshore.

Current management to protect the valuable natural and cultural resources within Ka‘ena Point include maintaining the existing boulder barricade, removal of invasive habitat-modifying weeds, and predator control. In cooperation with the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, the State Division of Forestry and Wildlife conducts regular small predator control, primarily using baited traps and shooting, that has decreased the size of feral predator populations within Ka‘ena Point NAR. However, with unlimited opportunities for entry, predator control requires constant effort and expense and does not provide a consistent level of protection for the native plants and animals within the NAR.

The devastating impacts of non-native mammals such as dogs, cats, mongoose, rats, and mice on island ecosystems are well-documented. Predation by invasive species is second only to habitat loss as the leading cause of avian extinctions and declines on islands, with rats and domestic cats implicated in most (72%) avian extinctions caused by invasive predators. Despite existing predator control efforts at Ka‘ena, attacks by cats and dogs continue to occur. For example, in 2006, 113 fledgling wedge-tailed shearwater chicks were killed in a single incident at Ka‘ena by a pack of dogs. Other high-mortality attacks at Ka‘ena include a 2005 incident in which a dog killed approximately twenty shearwaters, and a 1996 incident where forty nesting shearwaters were killed in one night.

While not as well-publicized, invasive rodents (rats and mice) constitute a greater threat to native species, contributing to extinctions and ecosystem-level changes. In Hawai‘i, rats have been documented to prey on ground-nesting seabirds, forest birds (including the endangered O‘ahu ‘elepaio), and the Laysan finch. In addition, as omnivorous feeders, rats are also known to eat the seeds, fruits, leaves, and shoots of Hawaiian plants, including chewing the apical and lateral buds of naupaka (*Scaevola sericea*), stripping the bark of koa (*Acacia koa*) saplings, and eating loulu (*Pritchardia* sp.) seeds. These actions either kill

the plant outright, make it more susceptible to disease, or prevent natural reproduction. The precise impact of rats and mice on the seabirds and vegetation at Ka‘ena is unknown, but is thought to be a continuing threat despite existing predator control efforts.

Finally, the predators found at Ka‘ena act as carriers of leptospirosis, morbilli virus (distemper), and toxoplasmosis. The recently published Recovery Plan for the Hawaiian Monk Seal identifies the transfer of these diseases as one of the threats to monk seal survival. Despite existing predator control efforts, the possibility of exposure continues as long as predators can enter the reserve.

The proposed predator-proof fence is a relatively recent technology developed in New Zealand. The fencing excludes non-native predatory animals as small as a two-day old mouse, and prevents these animals from digging under or climbing over the fence. The use of the predator-proof fencing is anticipated to increase the effectiveness of existing predator control efforts, shifting the focus from reducing predator numbers to eradication. The fencing will make it feasible to remove all non-native predatory animals from within the fenced unit and to focus control efforts on two entry points along the shoreline rather than across the entire peninsula.

Biologists familiar with these fences in New Zealand stated that “far more has been achieved at a far greater pace than expected” (Day, 2007). Benefits included a noticeable improvement in ecosystem function, a documented increase in the number and density of native invertebrates, and an increase in the diversity of plant vegetation. In one installation, the results projected to occur within 10 years of construction were observed in 18 months.

As the first full-scale predator-proof fence in Hawai‘i, the proposed fencing project provides an opportunity to prove the effectiveness of this new technology in Hawaiian coastal environments. Based on the experiences in other locations, the benefits of removing predators from Ka‘ena Point are anticipated to be extremely positive. The fencing will prevent the sporadic, high-mortality events caused by a feral dog in one night, but based on results from other island eradications, the removal of rodents may turn out to provide even greater conservation benefits than excluding dogs and cats.

Anticipated benefits are increases in the breeding Laysan albatross and wedge-tailed shearwater populations; the establishment of new seabird breeding populations, such as the ka‘upu or black-footed albatross (*Phoebastria nigripes*) and the ‘ou or Bulwer’s petrel (*Bulweria bulwerii*); a greater understanding of the impact of rodents on coastal ecosystems; improved health and function of the coastal strand plant community; improved natural regeneration or the re-introduction of the 11 endangered plant populations historically found at Ka‘ena; reduced risk of disease transfer to basking monk seals; and a demonstration area for residents and visitors to observe what the Hawaiian

islands might have been like in their natural state before the introduction of invasive mammals and to develop a greater appreciation of the value of the natural and cultural resources of Ka‘ena Point. Over the long-term, protecting the nesting area at Ka‘ena is of particular importance to vulnerable seabirds, as most of their nesting areas are located on atolls and islands at greater threat by rising sea levels than Ka‘ena.

The project area is situated on State land, within the Conservation District. As such, the project requires that an Environmental Assessment be prepared in accordance with Chapter 343 of the Hawai‘i Revised Statutes.

III. PROJECT DESCRIPTION

The Department of Land and Natural Resources proposes the construction of a predator-proof fence, to enclose approximately 59 acres of the peninsula of Ka‘ena Point. Figure 1 illustrates the area and the fence alignments under consideration.

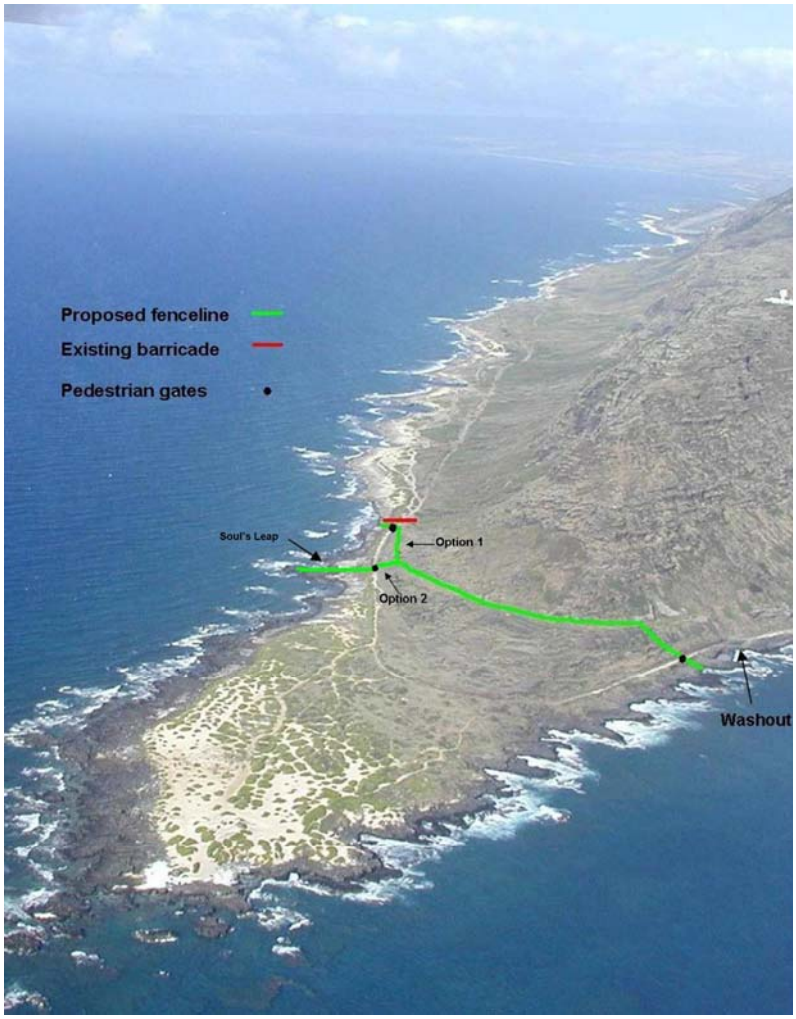

Figure 1. Aerial view of Ka‘ena Point with potential fence alignments superimposed.

The predator proof fence uses technology that has been used with great success in New Zealand in both coastal and forested areas. Trial predator-proof fences were constructed on the slopes of Mauna Loa, on Hawai‘i, demonstrating their effectiveness in excluding rats, cats, and mongoose and allowing the development of methods to exclude mice on ‘a‘ā substrate. Ka‘ena Point will be the first project-level fence of its type constructed in Hawai‘i. The project presents an exciting opportunity to utilize a fencing technology that may prove useful in other areas of Hawai‘i.

The proposed action can be divided into three phases: (1) fence corridor preparation and fence platform construction; (2) fence installation; and (3) predator eradication from within the fenced area.

The fencing corridor will be approximately four meters (13 feet) wide and 500 - 675 meters (1640 - 2200 feet) long, depending on the alignment selected. The fencing alignment largely follows a World War II-era roadbed that skirts along the bottom of the hill behind Ka‘ena Point, above the sand dunes. By following this track at the base of the slope, the alignment places the fence along the least visually intrusive area of the point, so that the greatest area might be enclosed while minimizing interference with viewplanes. On the Wai‘anae side, the fencing will contour down from the roadbed on the loose rock slope, cross the old railway easement (avoiding the railway retaining wall), and extend out towards the ocean along a rocky outcropping.

On the Mokulē‘ia side, two alignments are currently under consideration: the first runs along the roadbed to the existing boulder barricade, then crosses the old railway easement and extends to the ocean along a rocky outcropping; the second turns off the roadbed towards the ocean approximately 150 meters (500 feet) short of the boulder barricade, crosses the old railway easement and extends to the ocean along a rocky outcropping. The primary difference between the two alignments is that the first option encloses the culturally significant site, Leina a ka ‘Uhane (Soul’s Leap), within the fencing, while the second option does not. Other differences are outlined in the following table:

	Option 1: Fence extends to boulder barricade	Option 2: Fence ends about 150 m short of boulder barricade
Relative position of Leina a ka ‘Uhane (Soul’s Leap)	Enclosed within fenced unit	Remains outside the fenced unit
Length	677 meters	500 meters
Visual disturbance	Minimized impact, due to proximity to boulder barricade	Moderate impact, due to terrain

Distance to bird flight paths	Further from nesting birds	Closer to nesting birds

The final alignment will be selected based on consideration of public input, including input from cultural practitioners and lineal descendents of the area. Minor changes to the alignment are possible based on terrain considerations and permit requirements. Most of the length of the fencing alignment is within the boundaries of the NAR, but a small portion at the southern end (Wai‘anae side) will cross State Parks land as the fencing leaves the loose rock slope, crosses the railway easement, and extends to the ocean.

The existing roadbed that forms the main portion of the fence corridor is fairly level, and as a result, limited grading and little to no vegetation clearing will be required to make it suitable as a fence platform. Where the fencing leaves the existing roadbed, the corridor will be cleared of vegetation and some earthworks will be created to form the fencing platform. Ground preparation will involve the use of a bulldozer and excavator to move soil or rocks to form a level stable platform and to gently contour the ground so that rain water moves away from the fencing. No material would be imported from off-site; only soil and rock from within the planned fence corridor will be utilized. Overall, less than one acre of land area will be disturbed.

The fence design has three main elements: base fence, predator-proof mesh and skirt, and predator-proof rolled hood. The base fence provides the structural strength and framework on which predator-proof components may be added, and will be made of anodized aluminum posts and stays, with stainless steel wires and fastenings.

Fence materials and equipment will either be flown in by helicopter or driven and carried to the fence corridor. A container will be temporarily placed on-site, close to the boulder barricade on the Mokulē‘ia side, to provide secure storage for materials, tools, and equipment and to act as an on-site base of operations.

Anodized aluminum posts will be set into the ground three meters (9.8 feet) apart. One meter (3.3 feet) of the post will be buried, while two meters (6.5 feet) remains above ground. Marine grade stainless steel mesh with an aperture of 6 x 25 millimeters (0.2 x 1.0 inches) is attached to the entire face of the base fence, and is also used to form a skirt of horizontal mesh at ground level, to prevent predators from tunneling under the fencing. The mesh extends from the top of the posts to just below ground level, while the skirt will extend 300 millimeters (1 foot) from the fence, and will be pinned to the ground where possible.

Due to the largely rocky substrate found at Ka‘ena Point, the standard technique of pinning the mesh skirt into soft ground will likely prove ineffective. As such, a proven alternative strategy will likely be utilized:

- All overlapping skirt sections will be laced together using stainless steel tie wire.
- The leading edge of the mesh skirt will be positioned snugly against existing substrate.
- A dry mix of three parts fine rock particles to one part cement will then be applied over the skirt edge, holding the edge in place. If necessary, water may be applied to aid setting of the mix.

A rolled hood sits at the top of the fencing and extends 330 millimeters (1.1 feet) on the outside of the fencing. The hood is made of smooth sheet steel and prevents predators from climbing over the fence due to its slipperiness and width. The hood is supported by a series of brackets that give the hood structural strength without aiding predator movement.

Access doors are to be incorporated at locations where the fencing crosses existing trails. To minimize the opportunity for predator incursion if doors are propped open, a double-door system is planned where both doors cannot be open at the same time. Instead, a person accessing the reserve must wait for the first door to close before the second door may be opened. An emergency over-ride button will be incorporated into the design, on the interior of the fencing, so that individuals will not be trapped inside the reserve if someone props the outside door open. The area between the doors will be constructed with the same quality and design as the rest of the fence and will be large enough that up to nine people may enter together or so that a person can enter with a bicycle or fishing pole.

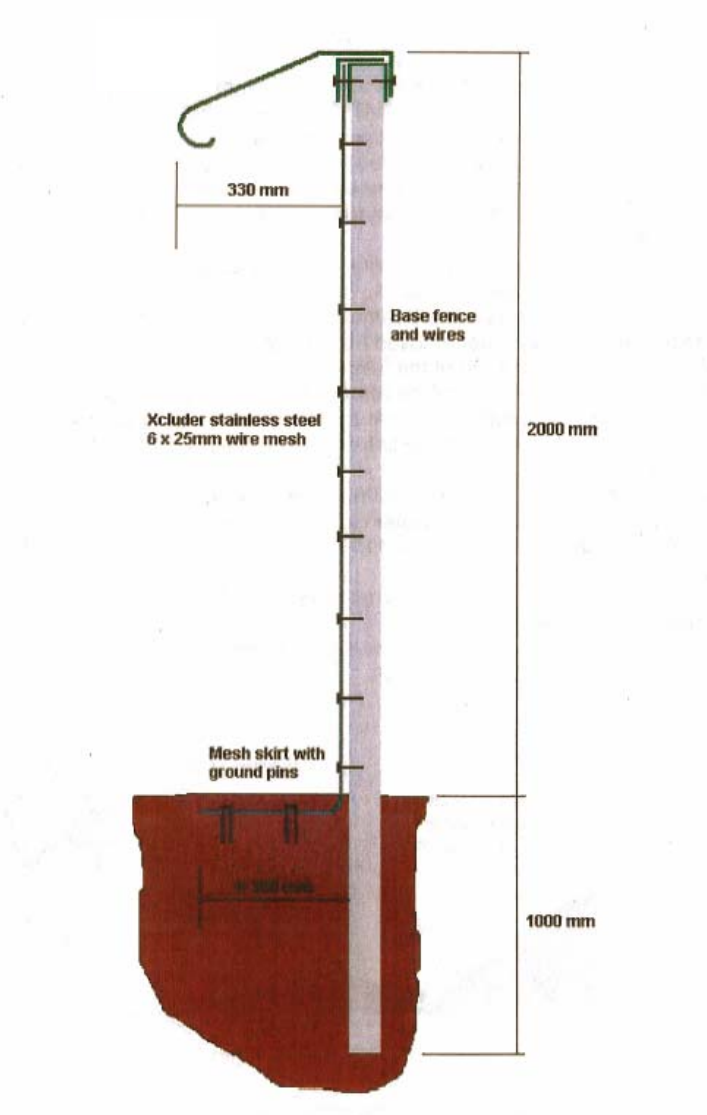

Figure 2. Schematic of proposed fencing.

Figure 3. Sample fencing and double door access system.

Figure 4. Front and side views of predator-proof fence on rocky terrain in New Zealand.

Figure 5. Predator-proof fence in coastal environment in New Zealand.

The fencing is planned to stop at approximately the high tide line, to avoid additional maintenance costs or damage due to rough seas or storm events. As a result, there may be a gap between the fencing and the ocean of up to fifteen feet, depending on tide and sea-state, which will require ongoing monitoring and

control to capture any predators that enter. The alignment on each end, utilizing rocky outcroppings, is specifically selected to present the optical illusion that the fence goes into the ocean without a gap, to discourage any potential predators from trying to cross into the reserve along the tideline.

Due to the potential for vandalism in this remote area, extra fence materials will be ordered and kept on-hand for repairs. The mesh size is too small to fit wire cutters through and too strong to be damaged by needle-nosed pliers, reducing the frequency and potential for damage to the mesh. Doors will be constructed of solid stainless steel with few moving parts to minimize potential for vandalism. If vandalism proves to be a large problem, the possibility exists to incorporate a monitoring system, using radios, cameras, and solar cells, to monitor activity near the fencing.

Upon completion of the fencing, all dogs, cats, mongoose, rats and mice will be removed from the fenced area to achieve the objective of a predator-free area. Potential techniques include trapping, shooting, and the use of Environmental Protection Agency-approved toxicants. Intensive eradication efforts and monitoring will continue until predator-free status has been achieved on the peninsula. At that point, predator control at key locations will continue to prevent or minimize re-introduction of predators into the fenced area. Regular monitoring of the entire fenceline will be a part of normal management for the area, to detect breaches for repair and regular monitoring of the interior and to detect ingress of any predator.

Weed control, outplanting of rare plants, and related habitat restoration efforts at Ka‘ena Point are ongoing and will continue after fence construction. Ka‘ena Point currently acts as an outdoor classroom where many students on O‘ahu come to learn about native species, and this activity is expected to continue. Additional signage at entry points, explaining why the fence was built and the importance of the natural resources protected by it, will be installed so that interaction with the fencing provides an opportunity for education.

Fence construction is planned to occur once all permissions and approvals have been received. Related conservation actions, such as predator control, weed control, outplanting, and outreach/education, are ongoing. Fence construction will be timed for October-early November or July-August. These time periods will avoid the Laysan albatross nesting season (November through June) and avoid the initial nesting period (April through June) and the primary fledging periods (September through October) for wedge-tailed shearwaters. Construction is anticipated to take approximately three to four weeks, weather-dependent. Fence crews will work in 2 10-day increments, with a break in between. Construction may involve temporary closures to the NAR, or portions of the NAR, for safety.

The fence is anticipated to cost approximately $250,000-$300,000 to construct. The total costs associated with predator control after the completion of fencing will depend on the success of initial control methods and the total amount of time it takes to remove predators from within the fenced unit. After predators have been removed, ongoing control activities along the edges of the fencing are anticipated to be about $10,000 per year.

Funding for this project is primarily through a grant awarded by the U.S. Fish and Wildlife Service to The Wildlife Society, Hawai‘i Chapter. The State is providing in-kind donations of staff time during the planning and permitting process. In addition, ongoing conservation management at Ka‘ena Point is made possible by State funds, primarily through the Natural Area Reserve Special Fund. The University of Hawai‘i is anticipated to provide in-kind donations by coordinating and implementing the monitoring of natural resources before and after construction. The predator-proof fencing is a cooperative effort of the State Department of Land and Natural Resources’ Division of State Parks and Division of Forestry and Wildlife, the U.S. Fish and Wildlife Service, and The Wildlife Society, Hawai‘i Chapter.

IV. SUMMARY DESCRIPTION OF AFFECTED ENVIRONMENT

Location and Physical Characteristics of the General Area

Ka‘ena Point is a wilderness area known for its unspoiled natural beauty, located on State land at the western corner of O‘ahu, in the ahupua‘a of Ka‘ena and Keawa‘ula. Ka‘ena Point Natural Area Reserve, established in 1983, forms the westernmost tip of this peninsula, and is entirely surrounded by Ka‘ena Point State Park lands.

The area contains shoreward basalt benches with numerous tidepools and a diverse intertidal flora and fauna, rare coastal sand dune communities, and rare coastal dry shrub and grasslands. Offshore from Ka‘ena is habitat for reef and pelagic fish, sea turtles, seabirds, and cetaceans.

The rugged, wind-swept peninsula consists of a low platform that extends 2100 feet beyond the base of high, wave-cut cliffs that converge like the prow of a ship behind Ka‘ena Point. The shore at the point is of black lava, mixed with white fragments disgorged from ancient coral reefs, and rises immediately to the heavily salt-spray influenced coastal strand and a band of sand dunes, before rising gently into rockier, less salty coastal zone shrublands at the base of the slope.

Above the low coastal platform, basalt-talus slopes tower above, rising to an elevation of 969 feet at Pu‘u Pueo directly above the point, with steep cliffs to the north and south. Though Kuaokalā Ridge, the westernmost extension of the Wai‘anae Mountain Range, descends relatively gently to the point compared with the steeper cliffs, it requires less than half a mile to gain nearly 1000 feet.

To the south of Ka‘ena, steep cliffs extend unbroken, past the beaches of Keawa‘ula (Yokohama) Bay, and into Mākua Valley. To the north of the point, the cliffs of Mokulē‘ia extend to the east, broken by ‘Ālau and Manini gulches, before continuing towards Dillingham Airfield.

The elevation in the project area ranges from sea level to approximately 100 feet. The project area is relatively dry; rainfall averages less than forty inches per year, with most occurring during winter. The landscape here is generally harsh, being heavily influenced by wind-blown salt spray and unsheltered from the sun, with consistent northeasterly tradewinds and an annual temperature range from 62-89°F.

Geology

The Island of O‘ahu was formed by the coalescence of two volcanoes, Ko‘olau to the east and the older Wai‘anae to the west, which may have built upon a still older volcanic mass. The Wai‘anae Volcano is thought to be approximately four million years old, while Ko‘olau is around 2.75 million years in age. The younger lava flows of Ko‘olau are banked against the slope of Wai‘anae, forming the broad Schofield Plateau. An erosional unconformity between rocks of the two volcanoes may be found along Kaukonahua Gulch, at the eastern foot of the Wai‘anae Range, where Wai‘anae lavas with a slope of 10-15° to the northeast are overlain by Ko‘olau flows dipping 5° northwest. Both volcanoes are now referred to as mountain ranges, as extensive erosion has formed the once-great shield volcanoes into what are essentially long, narrow ridges. What remains of Ko‘olau is the western half of the original volcano, as the entire eastern half slid cataclysmically into the ocean. This slide, known as the Nu‘uanu Slide, included much of the Kailua-area summit caldera. Massive fragments are strewn over the ocean floor as far as 100 miles to the northeast of O‘ahu. Wai‘anae Volcano was also subject to a massive slide, the southwest-trending Wai‘anae Slump. The Wai‘anae caldera was in the region west of Kolekole Pass, extending for about nine miles from the northern side of Mākaha Valley to the head of Nānākuli Valley.

The volcanoes of O‘ahu, as well as the majority of volcanoes in the main Hawaiian Islands – excluding Haleakalā on Maui and the Hawai‘i Island volcanoes other than Kohala – are considered to be dormant volcanoes in the rejuvenation, or renewed volcanism, stage. Though unlikely, renewed volcanic eruptions have been known to occur as late as five million years after emergence. Renewed volcanism eruptions usually consist of temporally and spatially limited episodes of isolated volcanic activity that occur on the heavily eroded slopes of old volcanoes, and generally show little relation to the orientation of earlier volcanic rift zones. Numerous examples of renewed volcanism episodes may be found on O‘ahu in association with Ko‘olau Volcano. These renewed eruptions began about 0.8 million years ago, with the most recent possibly occurring as recently as 6000 years ago. Resulting features may include cratered cones resulting from ash and cinder eruptions, such as

Diamond Head (Lē‘ahi), Punchbowl (Pūowaina), and Koko Crater (Kohelepelepe), or may be eruptions with lava flows and ash production, such as those that formed Mount Tantalus (Pu‘u ‘Ōhi‘a) and Round Top (Pu‘u ‘Ualaka‘a).

Fossilized coral reefs also comprise an important component of the geology of the Hawaiian Islands, and the emerged reefs found on O‘ahu are more extensive than on any of the other islands. The Honolulu and ‘Ewa Plains, as well as much of the rest of the southern edge of O‘ahu, are underlain by a broad, elevated coral reef. These emerged reefs are generally formed during interglacial sea level highstands. Most of the fossil reefs of southern O‘ahu are about twenty-five feet above current sea level, but evidence exists to indicate that, during the past two million years, eustatic sea level changes in Hawai‘i may have been as great as 250 feet above present levels and as low as 300 feet below current sea levels. At Ka‘ena Point, fossiliferous conglomerate is found eighty-nine feet above sea level, with loose coral cobbles as high as 100 feet up on Pu‘u Pueo, indicating a highstand of about ninety-five feet above present sea level. This highstand, known as the Ka‘ena Highstand and estimated to have begun between 423-362 thousand years ago, was one of the most significant interglacial highstand events of the past million years, and may have lasted approximately 60,000 years.

Ka‘ena Point itself is rich in fossil reef deposits, and has been referred to as a “geological museum” whose layers of fossilized reef are a “natural archive of global change” (Chip Fletcher; Honolulu Advertiser 1998). The oldest reef found here is the one associated with the Ka‘ena Highstand, some 100 feet above sea level. A lower stratum along the shoreline includes giant molluscs and coral heads and is about 130,000 years old. Fossilized reefs descend down the underwater extension of Kuaokalā Ridge to a vertical wall 100 feet deep, known as the Mākua Shelf.

The slopes of Pu‘u Pueo, as well as the underlying substrate in the Ka‘ena area, is composed of shield-building lava flows of the Kamaile‘unu Member of the Pliocene-era Wai‘anae Volcanics. There are also numerous sedimentary deposits of more recent vintage in the area, including the Holocene dune deposits of Ka‘ena Point, which are interspersed with smaller patches of calcareous reef rock and marine sediment – O‘ahu is the only island where these emerged reef deposits are exposed subaerially. The point itself is largely composed of dunes overlying fossil reefs and lava flows, as discussed above, but other sedimentary deposits on shores nearby include Holocene beach deposits and alluvium, which are composed chiefly of unconsolidated sediment, and are found along the coast and in drainages, respectively.

Soils in the project area are primarily characterized as beach (BS) and as rock lands (rRK). Beaches are described as sandy, gravelly, or cobbly areas washed by ocean waves, while rock lands are characterized as areas where exposed rock

covers 25-90% of the surface, with rock outcrops of basalt and andesite and shallow soils being the main characteristics. Beaches are considered highly suitable for recreational uses and resort development, while rock lands are suitable for pasture, wildlife habitat and water supply.

Groundwater beneath the project area is generally described as being basal (freshwater in contact with seawater), unconfined (not confined under pressure beneath relatively impermeable socks or soil), and within a sedimentary type aquifer. The aquifer is classified as a portion of the North aquifer sector, Mokulē‘ia system. The groundwater here is considered replaceable, not of importance either ecologically or as drinking water, and saline and, as such, is of limited importance.

Land Use

Both the State Park and the Natural Area Reserve are located in the Conservation District. The project area falls partially in the Resource Subzone (where the fencing joins the coastline) and partially in the Limited Subzone (along the old roadway). The area is zoned by the County as P-1 Restricted. The project area is located entirely within the County Special Management Area. A portion of the fencing project along the coastline is located within the tsunami evacuation zone.

Historically, the Ka‘ena coast may have supported small villages in the 1800s and early 1900s. The O‘ahu Railway and Land Company began operating a railway around the Point in 1898 to service sugarcane operations. The Coast Guard constructed a passing light for navigation purposes in 1920. Because of its strategic location, Ka‘ena Point was actively used by the military for coastal defense after World War I through World War II. Military use declined after World War II and the railway ceased operation in 1947. In 1971, the State Department of Transportation developed plans for a two-lane paved road around Ka‘ena Point. Due to significant opposition from the public, the concept was withdrawn. However, every so often, the idea of a road connecting the North Shore and Wai‘anae coast through Ka‘ena is raised again at the Legislature, most recently in 2000 (SCR 160). Continued public opposition, combined with the estimated high cost of the project, has prevented the road from becoming a high transportation priority.

During the 1970s, the State began to purchase lands in the area for a proposed Ka‘ena Point State Park. In 1978, a Ka‘ena Point State Park Conceptual Plan was completed. Ka‘ena Point NAR was established in 1983, composed of twelve acres on the leeward side of the point. In 1986, an additional twenty-two acres on the windward side were added to the NAR.

The project area is one of the last relatively wild areas on O‘ahu and has been valued as a natural escape from the pressures of urban life. Ka‘ena Point NAR is accessible to the public by foot or bicycle, and its primary uses include

recreation, hiking, nature study, education, and the observation of wildlife. Shore fishing, spear fishing, and gathering of marine resources have traditionally been important uses of the Ka‘ena coast. A site ½ mile off of Ka‘ena Point is used by surfers, and during rare combinations of winter conditions, rideable 50-60 foot surf has been seen.

Flora

The area of Ka‘ena Point is generally affected by sun, salt spray, and seawater, and is limited by the sandy, rocky substrate. This sort of challenging, coastal strand environment is usually dominated by low shrubs and perennial herbs, vegetation that is adapted for such conditions. Farther uphill in the coastal zone, where the influence of salt and wind is less acute, arid shrublands are generally found. Appendix B includes a partial inventory of the flora and fauna found at Ka‘ena Point. Two native natural communities are found in Ka‘ena Point Natural Area Reserve, the rare Naupaka (*Scaevola sericea*) Mixed Coastal Dry Shrubland and an ‘Ilima (*Sida fallax*) Coastal Dry Mixed Shrub and Grassland. Though naupaka itself is not rare, this community type was classified by the Hawai‘i Heritage Program to be critically imperiled globally, meaning that there are 1-5 occurrences worldwide. The ‘ilima community is considered to have a restricted range, of 21-100 occurrences.

Naupaka Mixed Coastal Dry Shrubland dominates the point. This community occurs on dunes and fossil reefs from the high-water mark throughout the coastal strand, and is generally dominated by a dense but non-continuous canopy of naupaka kahakai (*Scaevola sericea*). In the Reserve, the naupaka canopy is generally 2-4 feet in height, and opens to a varied cover of low grasses and shrubs that includes ‘aki‘aki (*Sporobolus virginicus*), pōhinahina (*Vitex rotundifolia*), hinahina kū kahakai (*Heliotropium anomalum* var. *argenteum*), and pā‘ū o Hi‘iaka (*Jacquemontia ovalifolia* subsp. *sandwicensis*). With the absence of off-road vehicles, this community is recovering well.

The ‘Ilima Coastal Dry Mixed Shrub and Grassland community covers the gentle alluvial slopes above the sand dunes in the Reserve as a thin strip, rarely exceeding eighty feet in elevation. This community is capable of withstanding extreme drought conditions. The dominant ‘ilima is a shrub that can be prostrate or upright to more than three feet. In addition to ‘ilima, there may be a variety of codominant native shrubs and grasses. The prostrate vine pā‘ū o Hi‘iaka is the most frequent codominant with the ‘ilima in the Reserve. Taller native shrubs, such as naupaka and naio (*Myoporum sandwicense*), are scattered throughout the community. Other shrubs include alena (*Boerhavia repens*) and ‘ōhelo kai (*Lycium sandwicense*). Pili grass (*Heteropogon contortus*) and the upright shrub ma‘o (*Abutilon incanum*) are locally common in the upper reaches of the community and nehe (*Wollastonia integrifolia*) nearer the point. Also found near the point is an endangered variety of ‘akoko endemic to Ka‘ena (*Chamaesyce celastroides* var. *kaenana*). Invasion by non-native plants presents a serious problem for this community.

Other notable native plants found within the Reserve include the endangered species ‘ohai (*Sesbania tomentosa*) and one of the only known occurrences of the endangered *Schiedea kealiae*. In total, eleven endangered plant species have been recorded at Ka‘ena Point, and the area is designated as critical habitat for seven of those species. Also known from the area is Hawaiian cotton, called ma‘o or huluhulu (*Gossypium tomentosum*). A full list of notable species of flora and fauna thought to occur in or near the project area is including in Appendix A.

Outside the Reserve, other native plant communities may be found nearby. The rare Alahe‘e (*Psydrax odorata*) Mixed Lowland Dry Shrubland exists in relatively dry regions of basaltic slopes, and is found from 50-800 feet in elevation on the windward slopes from ‘Ālau Gulch to Manini Gulch. Alahe‘e growth is densest on the upper talus slopes and the lower cliff edges, with canopy height from 3-10 feet, depending on wind exposure. Common native shrubs of the understory include ‘ilie‘e (*Plumbago zeylanica*) and ‘ilima, and native vines such as koali (*Ipomoea indica*, *I. cairica*) and huehue (*Cocculus trilobus*) are common. During the wet winter season, the annual native vine ‘ānunu (*Sicyos pachycarpus*) is profuse. Other native vegetation associated with this community are the grasses pili, kāwelu (*Eragrostis variabilis*), and kākonakona (*Panicum torridum*), the herb ‘ala‘ala wai nui (*Peperomia leptostachya*), and kumuniu (*Dryopteris decipiens*), a fern. In the Ka‘ena area, the alahe‘e shrublands are severely degraded, with weed cover exceeding 50% in most areas.

Kāwelu Coastal Dry Grassland typically occurs on basaltic coastal cliffs, and is found in the Ka‘ena region on steep windward cliffs and the upper reaches of talus slopes. The grasslands attain their best development closest to Ka‘ena Point at about forty feet in elevation, but extend east to ‘Ālau Gulch and up to 800 feet in elevation near the cliff tops. Kāwelu grasslands tend to form a low cover – generally less than twenty-five inches – and reach a maximum on slopes exposed to the prevailing winds. Distributed among the kāwelu are other native grasses, such as kākonakona and pili, and native shrubs such as ‘ilima. A scattering of taller shrubs, such as naio and alahe‘e, often project above the short canopy. Largely bare rock faces amidst kāwelu often support the shrub hinahina kuahiwi (*Artemisia australis*). An interesting phase of this community may be found near the point, where ‘akoko (*Chamaesyce* sp.) is codominant with kāwelu in a small area. Non-native grasses and shrubs are invading to various degrees.

Naio Coastal Dry Shrubland, also considered a rare community, is known only from a few areas in the Hawaiian Islands, including the Ka‘ena coast. These shrublands cover extensive areas of the windward side from near the point to beyond Manini Gulch. Starting on the gentle alluvial fans at the base of the talus slopes, the shrublands extend up the slopes, sometimes onto the basalt

ledges. This community is characterized by scattered, rounded naio shrubs, from 3-8 feet tall, with other shorter shrubs and grasses between. The most common are ‘ilima and a rare nehe (*Wollastonia lobata* var. *lobata*), with occasional patches of native grasses, such as pili, kāwelu, and kākonakona. The native shrub alahe‘e is also common. The naio shrublands at Ka‘ena are highly degraded by non-native species.

Non-native plants in the area compete with native vegetation, especially in areas outside the Reserve. Koa haole (*Leucaena leucocephala*) dominates many of the dry slopes near Ka‘ena on the leeward side, forming a non-native community referred to as Koa haole Mixed Coastal Dry Shrubland. Koa haole typically covers 70-90% of drier leeward slopes and 25-50% of windward slopes, but had shown a decline in the late-1980s due to the introduction of a non-native psyllid, *Heteropsylla cubana* (Psyllidae), resulting in emergence of native shrubs such as ma‘o and ‘ilima in some formerly infested areas. Within koa haole shrublands a variety of non-native grasses, shrubs, and herbs exist. Guinea grass (*Panicum maximum*) heavily infests the flats near the road and on the lower slopes, and kiawe (*Prosopis pallida*) is intermittent on the lower slopes and flats, with 5-10% coverage on the windward side. Other abundant weeds are the grasses swollen fingergrass (*Chloris barbata*), with up to 25% coverage of roadside areas and mid-slopes, and sourgrass (*Digitaria insularis*), which is found in the flats and open areas near the road and dominates open areas around koa haole stands. Buffel grass (*Cenchrus ciliaris*) is another common non-native grass. Vegetation along the proposed fencing corridor is primarily non-native.

Fauna

Both Laysan albatrosses and wedge-tailed shearwaters have re-established breeding colonies in the Reserve. Currently, approximately 60 pairs of Laysan albatross nest at Ka‘ena Point, along with over 1,500 pairs of wedge-tailed shearwaters.

The success of a breeding population of Laysan albatross at Ka‘ena Point is of particular importance, as it is one of only three communities in the main Hawaiian Islands. Considered a species of concern vulnerable to extinction by the World Conservation Union (IUCN), populations of Laysan albatrosses have not fully recovered from widespread feather hunting that took place in the early 1900s, and now face threats from longline fisheries and lead poisoning of the major population at Midway. Laysan albatrosses, or mōlī (*Phoebastria immutabilis*), spend the majority of their lives at sea, coming ashore only for breeding purposes. The birds, which can live at least fifty years, mate for life. At 7-10 years in age, birds begin courtship rituals, involving elaborate dancing and calls. Breeding pairs will return to the same nest site every year. While the breeding season runs from November through June each year, birds usually begin to arrive in October, and the last chicks may not leave until July. As ground nesting birds, Laysan albatross are particularly vulnerable to predation.

The wedge-tailed shearwater, or ‘ua‘u kani (*Puffinus pacificus*), is relatively abundant at Ka‘ena Point. Populations in Hawai‘i historically numbered in the tens of millions; they are now considered “common” seabirds with an estimated population of only 40-60,000 pairs in the main Hawaiian Islands. The Hawaiian name for the bird means moaning petrel, and refers to the various strange nocturnal moans, groans, and wails heard from a nesting colony. These shearwaters are also pelagic birds, spending the majority of their lives at sea, and will usually depart the colony before dawn and return after dusk. Adults usually arrive in March, and females lay a single egg in June. As ground nesting birds, shearwaters face threats from feral predators at nesting sites and also easily disoriented by urban lights.

White-tailed tropicbirds, or koa‘e kea (*Phaethon lepturus*), have also been known to nest at Ka‘ena Point in small numbers. Other seabirds, including red-footed (*Sula sula*), brown (*S. leucogaster*), and masked (*S. dactylatra*) boobies, collectively known as ‘ā; brown (noio kōhā, *Anous stolidus*) and black noddies (noio, *Anous minutus*); ‘ou or Bulwer’s petrel (*Bulweria bulwerii*) and an occasional ka‘upu or black-footed albatross (*Phoebastria nigripes*), have been observed from the point. Great frigatebirds, or ‘iwa (*Fregata minor*); and grey-backed (pākalakala, *Sterna lunata*), sooty (‘ewa‘ewa, *S. fuscata*), and white (manu-o-Kū, *Gygis alba*) terns have been observed at Ka‘ena on occasion, and any number of other seabirds could potentially be seen here. Migratory shorebirds, including the wandering tattler, or ‘ūlili (*Heteroscelus incana*); Pacific golden-plover, or kōlea (*Pluvialis fulva*); and ruddy turnstone (‘akekeke, *Arenaria interpres*) may also be seen. All of the seabirds and shorebirds found at Ka‘ena Point are federally protected under the Migratory Bird Treaty Act of 1918.

Hawaiian short-eared owls, or pueo (*Asio flammeus sandwichensis*), have been seen in the Reserve, and it is possible that they may nest in the Reserve or nearby. And, while not generally observed, the tide pools of the Ka‘ena coast could provide temporary habitat for the endangered Hawaiian coot, or ‘alae ke‘oke‘o (*Fulica alai*).

It is possible that, with the protection afforded by the predator-proof fence, one or more of the species of seabirds will establish nesting colonies at Ka‘ena Point. Bulwer’s petrels have been observed in the area and might have unsuccessfully attempted to nest in shearwater burrows, and the removal of rats could result in their return. Black-footed albatrosses are thought to have been observed ‘prospecting’ for nesting sites. The FWS has just initiated the review process to consider listing the black-footed albatross as threatened or endangered, and is considered by the IUCN to be globally endangered, on the basis of a projected 60% population decline over the next fifty years due to incidental mortality in longline fisheries.

The reserve also acts as a refuge for the endangered Hawaiian monk seal, or ‘īlioholoikauaua (*Monachus schauinslandi*), and for honu, or green sea turtles (*Chelonia mydas*). The subtropical monk seal genus (*Monachus* sp.) is one of the most highly endangered groups of animals in the world. Only three species are known from modern times. Of these, the Caribbean monk seal is now extinct, the Mediterranean monk seal is considered by the IUCN to be critically endangered, and the Hawaiian monk seal is listed as endangered by both the USFWS and the IUCN. Observations of the Hawaiian monk seal, or ‘īlioholoikauaua (*Monachus schauinslandi*), sunning on the beach or the rocks at the point have increased over the past decade. Several individuals are regulars at Ka‘ena Point, and a female seal gave birth to and successfully raised a pup there in 2006.

Honu, or green sea turtles (*Chelonia mydas*), are known to utilize the shallow waters of Ka‘ena Point for resting and feeding, and are federally listed as a threatened species in Hawai‘i. Humpback whales (koholā, *Megaptera novaeangliae*), listed as an endangered species, are commonly seen in the waters off the point during the winter breeding season. Hawaiian spinner dolphins (nai‘a, *Stenella longirostris*) may also be seen in the waters near Ka‘ena Point.

Little documented information exists regarding native invertebrates within the reserve. Native bees of the genus *Hylaeus* (Colletidae) are thought to pollinate the rare native plant ‘ohai (*Sesbania tomentosa*). A native Succineid land snail is known from Ka‘ena. Non-native invertebrates are common in the reserve, and an unstudied entomofauna is known to exist in association with seabirds.

Non-native birds are commonly seen in the Reserve. These include the red-crested cardinal (*Paroaria coronata*), bulbul (*Pycnonotus* sp.), common myna (*Acridotheres tristis*), Japanese white-eye (*Zosterops japonicus*), spotted dove (*Streptopelia chinensis*), zebra dove (*Geopelia striata*), house finch (*Carpodacus mexicanus*), Northern mockingbird (*Mimus polyglottos*), grey francolin (*Francolinus pondicerianus*), and Erckel’s francolin (*Francolinus erckelii*).

Non-native predators are also present in varying numbers within the reserve, and these are the primary motivation for the proposal of a predator-proof fence. Problem animals for the reserve include feral dogs (‘īlio, *Canis lupus familiaris*) and cats (pōpoki, *Felis silvestris catus*), as well as the black rat (*Rattus rattus*), Polynesian rat (‘iole, *R. exulans*), house mouse (*Mus musculus*), and Indian mongoose (*Herpestes javanicus*).

Significant and Sensitive Habitats

The State considers Ka‘ena Point to be significant and sensitive habitat for a variety of reasons.

Ka‘ena Point is considered by many to be the last wild stretch of coastline on O‘ahu. By restricting vehicular access into the Natural Area Reserve, damage to the coastal dunes, the surrounding terrain, cultural sites, and vegetation was halted and the ecosystem has demonstrated remarkable recovery. Despite their recovery, these coastal resources remain fragile and coastal dune remain rare across the State.

The project area is also designated critical habitat for seven endangered species of plants: ‘ohai (*Sesbania tomentosa*), ‘āwiwi (*Centaurium sebaeoides*), ‘akoko (*Chamaesyce celastroides* var. *kaenana*), *Vigna o-wahuensis*, pu‘uk‘aa (*Cyperus trachysanthos*), ma‘o hau hele (*Hibiscus brackenridgei*), and *Schiedea kealiae*. Ka‘ena Point provides important habitat for nesting seabirds, in particular the Laysan albatross, and is commonly used by the endangered Hawaiian monk seal.

Finally, Ka‘ena Point was proposed as a Natural National Landmark in a 1981 National Park Service survey of the Hawaiian Islands.

Archaeological Sites and Cultural Practices

The following steps were taken to determine the cultural and historical significance of the project area: (1) field inspections by the Division of State Parks archaeologist; (2) review of State reports and documents available in the State Parks and State Forestry and Wildlife files; (3) literature review for sources with information relevance to the project area; (4) preparation of a Summary of Known and Possible Historic Properties at Ka‘ena Point by the Division of State Parks archaeologist; (5) sending of pre-consultation letters to a wide variety of agencies and organizations that might be interested in the project or have relevant information about archaeological or historic sites or cultural practices, including: US Air Force, Ka‘ena Point Tracking Station, US Army Museum of Hawai‘i, State Historic Preservation Division, Office of Hawaiian Affairs, Department of Hawaiian Home Lands, O‘ahu Island Burial Council, ‘Ahahui Mālama I Ka Lōkahi, Ahupua‘a Action Alliance, Hawaiian Civic Club of Waialua, Hawaiian Civic Club of Wai‘anae, Hawai‘i Railway Society, Historic Hawai‘i Foundation, Ho‘omau Ke Ola, Hui Mālama I Nā Kūpuna O Hawai‘i Nei, Hui Mālama o Mākua, ‘Ike ‘Āina, KAHEA – The Hawaiian-Environmental Coalition, Kai Makana, Nani ‘O Wai‘anae, Native Hawaiian Legal Corporation, North Shore Kūpuna, and Polynesian Voyaging Society; and (6) meetings with identified groups or individuals connected to the area. A summary of the archaeological and cultural resources found at Ka‘ena Point is presented below.

The Ka‘ena Point area was traditionally separated into different land divisions, with the north side belonging to the Ka‘ena ahupua‘a of the Waialua moku, and the south side of the point belonging to the Keawa‘ula ahupua‘a of the Wai‘anae moku. Ka‘ena, which literally translates as ‘the heat,’ is thought to have been named for a brother or cousin of Pele. Other sources note that Ka‘ena means ‘the end point,’ underlining the area’s cultural significance as a sacred place

where the spirit goes after death. Keawa‘ula translates to ‘the red harbor;’ the name comes from the great schools of muhe‘e (cuttlefish) that came into the bay in such numbers, the reddish color of their back under the water gave the water the appearance of being reddish.

Ka‘ena Point itself is a culturally significant landscape. There is a strong relationship in Native Hawaiian culture between the people and the land on which they live. The ‘āina (land), wai (water), and kai (ocean) formed the basis of life and established the spiritual relationship between the people and the environment. This relationship is demonstrated through traditional mele (songs), pule (prayer chants), genealogical records, and stories about particular areas, celebrating the qualities and features of the land. The relationship to the land is also shown through the strong attachments of kama‘āina to their ancestral homelands. For example, Thomas Shirai Jr. traces his genealogy in Waialua at least seven generations, was raised in Mokulē‘ia, and remains active in the Waialua moku. His ancestors, including his great-great-grandfather Kaaemoku Kakulu, his great-great-grandmother Annie Keahipaka, and his great-grandfather David Keao, provided information about Ka‘ena during previous endeavors to record traditional Hawaiian knowledge (Handy’s The Hawaiian Planter and McAlister’s Archaeology of Oahu). Mr. Shirai continues the tradition by sharing family stories that illustrate the importance of Ka‘ena for marine resources.

Mr. Shirai shared that he and his grandparents would periodically go to Ka‘ena to gather shellfish (‘opihi and pipipi), seaweed (limu kohu), sea cucumber (loli), sea urchin (wana, hā‘uke‘uke, and hāwa‘e), and other resources, and that they would make pa‘akai (salt) on a parcel of land his family owned at Ka‘ena. His grandfather was a taro farmer and lobster fisherman, who used Ka‘ena as one of his fishing grounds. His grandfather learned his skills from his grandfather, Kaaemoku Kakulu, the last konohiki of Kawaihāpai, located between Waialua and Ka‘ena.

In an article published in the Hawai‘i Fishing News, Mr. Shirai connected old family stories to modern events. After relaying a family version of the story of how the Pōhaku o Kaua‘i was formed (repeated below), he tells a story of how Maui caught a huge red fish (kūmū) at Ka‘ena and dragged it to Kuakala Heiau, where the menehune found it, named it Kumunuiakea, and cut it into small pieces. When the sea covered the land, pieces of the fish went back into the ocean, and since then kūmū at Ka‘ena are small. Mr. Shirai then recalls a 1994 Hawai‘i Fishing News story remembering how three scuba divers discovered a pristine kūmū fishing ground, catching many of this species, but of an average size of five pounds, back in 1957.

Mr. Shirai shared a third story, about an octopus called Kakahe‘e that lived at Ka‘ena. Piikoi-a-ak-Alala and his father were traveling to O‘ahu where they sighted a huge octopus. They took aim and shot at Kakahe‘e with a bow and

arrow, then landed at Waiakaaiea and proceeded to beat it to death. Kakahe‘e is reported to have shared the same fate as Kumunuiakea, thus creating an abundance of he‘e (octopus). Mr. Shirai then notes that the State record for largest octopus was caught at Ka‘ena, and that the February 1994 issue of Hawai‘i Fishing News featured a fisherman who caught a large octopus at Ka‘ena.

These stories provide invaluable information about Ka‘ena and connect historic events with present use. There are likely many other residents of Wai‘anae and Waialua with similar stories and recollections. While most likely involve the rich marine resources of Ka‘ena, many of the native plants found at Ka‘ena are also associated with traditional cultural practices and may have been used by previous families. ‘Ilima papa vines were used for basketry, the flowers for lei, and parts of the plant for medicinal and ceremonial purposes; hinahina was used for lei and medicinal purposes; and naio provided hard durable wood and was used for medicinal purposes.

Sites of O‘ahu (1978) identifies several archaeological sites in the Mokulē‘ia-Ka‘ena region. In Kamananui, on the slopes of the Wai‘anae Mountain Range behind the old Waialua Sugar Company mill, the remains of a heiau were found along with stone piles and burial caves. Makai of these sites, along the coastline, were found a fishing shrine, or ko‘a, and skeletal remains. In western Mokulē‘ia, a heiau site and a ko‘a – both now destroyed – as well as extensive terracing have been recorded. Further into the valley area are sites that indicate that there was once a significant Hawaiian settlement there, including house sites, old coconut trees or dead trunks, and terracing. In Kawaihāpai, between Waialua and Ka‘ena, a heiau, ahu, ko‘a, and extensive terracing were recorded, as well as the four ‘hidden waters.’ These are the legendary streamlets Ulunui, Koheiki, Ulehulu, and Waiaka‘aiea that Hi‘iaka, one of the sisters of Pele, discovered at Ka‘ena and at which she quenched her thirst. The Keālia Trail, which zigzags up into the Wai‘anae Mountain Range from the coast, provided easy access to the Mokulē‘ia plateau. The Moka‘ena heiau in Kuaokalā, situated on the ridge at 1200 feet in elevation overlooking Ka‘ena Point and Keawa‘ula Bay, has the highest location of any heiau on O‘ahu. At Ka‘ena, the now-destroyed Ulehulu heiau was also located on the mountain ridge.

Historic properties identified so far at Ka‘ena Point within or near the project area fall within one of the following four major time-periods and uses: (1) Native Hawaiian subsistence and cultural uses; (2) Pasturage and ranching; (3) O‘ahu Railway and Land Company (OR&L); and (4) Ka‘ena Point Military Reservation. The following information is based on the Summary of Known and Possible Historic Sites; the full report, with photos, is included as Appendix C.

To date, a total of five extant historic properties that are considered native Hawaiian properties have been documented at Ka‘ena Point. Together they form the Ka‘ena Complex, which was listed on the Hawai‘i Register of Historic

Places in 1988. Major features of the Ka‘ena Complex include cultural deposits in the sand dune area, two stone platforms, Pōhaku o Kauai, and Leina a ka ‘Uhane (Soul’s Leap).

The oldest of these properties are the subsurface cultural deposits and burials in the sand dune area near the actual point. These sites were first documented in 1971, and recorded in more detail during a 1982 recovery effort prompted by deterioration of the sand-dune knoll due to off-road vehicle use. As part of the 1982 effort, two partial burials exposed by erosion were removed and placed in a more stable reburial site for protection. Additional data recovery work was conducted in 1989. Prior to 1989, the site was described as having remnant walls constructed of water-worn basalt stones and two distinct buried cultural layers. The two cultural layers were marked by dark, charcoal-stained sand containing coral and basalt ‘ili‘ili (water-worn pebbles), pit features, a few artifacts, and midden composed of bird and fish bone, crab, sea urchin, kukui nut fragments, marine shells, and charcoal pieces. The stone walls had been reduced to foundation alignments in 1982 and 1989, and the upper cultural layer was no longer intact by 1989. An analysis of the lower layer in 1989 indicated the long-standing importance of fishing and marine resources in this dry environment, and the presence of habitation features suggested a sustained use of the area, whether on a permanent or recurrent basis. Spatially, the cultural deposits extend over an area approximately 30 by 50 meters, and surface midden scatters and darkened sand exposure indicate that the deposits could extend an additional 300 meters to the east and 30 meters to the south.

The two stone platforms included in the Hawai‘i Register complex are thought to have been constructed for religious purposes. One was described in 1988 as a partially buried basalt boulder platform with coral pieces scattered among the boulder paving of the platform. The presence of coral and the location of the platform on a distinct rise above the sand dunes indicate that it could be a fishing ko‘a (shrine or triangulation point). It is possible, but not confirmed, that this could be Alau‘iki, a fishing shrine recorded in 1930 by McAllister.

The second stone feature is upslope from Leina a ka ‘Uhane (Soul’s Leap), above the proposed fence alignment. It has been described as a “small rectangular platform of basalt cobbles, with scattered coral on the surface.” Its possible religious function is suggested by its size, the presence of coral, upright stones along the edge of the platform, and its vantage point. The possible ritualistic nature of these two features is consistent with the prevalence of known fishing shrines in the area and with the richness of its fisheries. McAllister recorded eight named ko‘a between Keawa‘ula and Mokulē‘ia.

Two natural formations compose the remaining two features of the Ka‘ena Complex: Pōhaku o Kaua‘i and Leina a ka ‘Uhane (Soul’s Leap). Both should be considered traditional cultural properties; the identification and evaluation of these otherwise natural features rely on known native Hawaiian traditions and

beliefs. Pōhaku o Kaua‘i marks the end of a series of partially submerged rock outcrops that form the westernmost extent of O‘ahu. According to several recorded traditions, this rock formation was once part of Kaua‘i. In one tradition, the demigod Maui attempts to join Kaua‘i and O‘ahu by standing at Ka‘ena Point and using his hook, Manaiakalani, to pull Kaua‘i towards O‘ahu. When he pulled the hook, only a single, huge rock from Kaua‘i fell at his feet, to become known as the Pōhaku o Kaua‘i. The hook was attached to ‘ie‘ie cordage, which ended up in Ka‘ie‘ie Channel (between Kaua‘i and O‘ahu) and the hook landed in Pālolo Valley, hollowing out a crater. In a related version told by Annie Keahipaka, a lineal descendant of the area, Maui had many helpers pulling the line. When one disobeyed orders and looked back at Kaua‘i as they pulled it towards O‘ahu, the line broke and Kaua‘i slipped back into the ocean, with only the fragment Pōhaku o Kaua‘i remaining as proof of Maui’s great effort. In a third tradition, a Kaua‘i chief named Ha‘upu hurled a huge boulder from Kaua‘i to O‘ahu to forestall what he thought was a fleet of O‘ahu warriors about to invade Kaua‘i. The group was, in fact, driving fish towards nets laid off-shore of O‘ahu. When the boulder fell, it killed the chief Ka‘ena who was leading the drive and many of his followers. From then on, the point bore the name of this chief and the rock was called Pōhaku o Kaua‘i. Pōhaku o Kaua‘i is also mentioned incidentally in other traditions, demonstrating that it was a commonly known landmark.

Leina a ka ‘Uhane (Soul’s Leap) is a limestone formation approximately 150 meters (500 feet) from the existing boulder barricade, perched between the existing trail and the ocean. It forms a tangible representation of native Hawaiian traditions and beliefs that identify Ka‘ena Point as a place where the fate of departing souls is determined as death nears. Departing souls either passed into one of several spirit realms or were returned to the body to continue life. The fate of these souls often depended on the help or absence of friendly ‘aumakua (ancestral family or personal god) that would guide a soul to the appropriate realm: ao kuewa, a place of wandering souls, ao ‘aumakua, where the soul could be reunited with the souls of ancestors, or au milo or pō pau ‘ole, a place of eternal night. In another version of what happens to souls after death, a soul wanders to Leina a ka ‘Uhane if all its earthly obligations are fulfilled (if they are not, the soul returns to the body), where it is thrown into a pit know as Lua ahi a Kehena, at which time death actually occurs to the body.

A road, following the traditional Wai‘anae-Waialua trail, was constructed through the area and around the point sometime in the 1860s-70s. Several small fishing villages are thought to have existed in the area during this period. A settlement called Nēnēle‘a is documented as being about a mile east of Ka‘ena Point, and several house foundations, measuring 14 x 20 feet, are documented from the area. An 1832 census listed the population of the Ka‘ena ahupua‘a at forty-nine individuals. Based on the known fishing shrines, recorded interviews, and the number of stories, fishing was an important activity. Ka‘ena is noted as an excellent fishing ground, and one story describes how Maui

caught a huge red fish, which left a trail from Pōhaku o Kauai to Kuakala heiau (up in the mountains) as he dragged it. The menehune found the fish and cut it into small pieces, which went back in the ocean when the sea covered the land, and is the reason why kūmū (goatfish, *Parapeneus porphyreus*) are now small.

Based on historic accounts and recorded traditions, there may be additional as-yet unidentified historic properties at Ka‘ena Point and would most likely reflect uses and customs associated with the area’s rich fisheries and the lack of any other dominant land use in this waterless hot area. These could include additional ko‘a, the remnants of shelters and settlements for fishermen, burials, canoe landings, and salt-making sites. However, later uses of the area (described further below) have significantly reduced the probability of these properties surviving on the flatter portions of the Point or along lower ridge slopes.

The first reference to lands at Ka‘ena being used for pasturage appear in survey notes by J.S. Emerson for 5 Royal Patent Grants. These government grants reflect a district-wide attempt by Waialua residents to secure land for pasturage and may also provide evidence that permanent settlements were absent along this coast in 1850. Most of the government lands and private lands at Ka‘ena were leased for ranching during the second half of the 1800s and the first half of the 1900s. When the privately-owned lands along the coast were acquired by the State of Hawai‘i in the 1970s to create Ka‘ena Point State Park, all were owned by ranching interests or by families with ranching interests in the area. Despite references to Ka‘ena Point and adjacent lands being used for pasturage, none of the stone features or sites generally associated with grazing or ranching have been identified at the Point or within the project area. There are no stone wall enclosures or corrals, nor do the boundaries of the grants appear to have been walled to contain grazing cattle or horses.

The former alignment and features of the O‘ahu Railway and Land Company (OR&L) railway are among the most visible historic properties at Ka‘ena Point. Completed in 1898, the railway connected Honolulu to Kahuku, via Wai‘anae and Waialua. It was meant to serve plantation towns and ranches, but also became a scenic tour. Railway service ended and the railway was abandoned in 1947, after damage by a 1946 tsunami and a decline in railroad use caused by the increase of personal vehicles. The main railway bed is still visible through its route through Ka‘ena, but no traces of the tracks or railroad ties remain. Today, the railway bed forms the primary path used by visitors hiking out to the Point. Rock-work features associated with the railway such as bridge foundations, culverts, and rock retaining walls can still be observed along the railroad track. In addition to the main railway line, a 15-car siding track once ran from the northern side of the bend to the Point and is depicted on 1929 and 1940 USGS topographic maps. No physical evidence of this siding was apparent during the field inspection.

Finally, Ka‘ena contains historic features associated with its military use. Ka‘ena Point Military Reservation was established in 1923; construction of military defense facilities began in 1924 and continued through 1946, capitalizing on the strategic location of Ka‘ena Point. Four complexes of structures and associated features still exist within or near the project area, and a fifth could be identified with additional field inspections. These include a fire control and base end stations built on a ridge knoll (above Ka‘ena Point) in 1924 and 1934, a radar station used in the 1940s (located on the ridge above Ka‘ena Point), a search light position established in 1942, a cantonment established in 1942 for military personnel manning the various operations (“Camp Ka‘ena,” located on the flat area down at Ka‘ena Point), and a battery begun in 1943. The concrete structures associated with the fire control and base end station remain intact, the concrete foundations of Camp Ka‘ena remain recognizable, and concrete structures associated with a radar station remain visible.

The battery, BCN-409, was designed to support two 8-inch naval guns and army M1 barbette cartridges. It involved the construction of a tunnel complex and was 60% complete when the project was abandoned in 1945, after studies determined that batteries of this type could not withstand modern air attack. Given the elevation of the tunnel entrances, a substantial amount of cut and fill was needed to create the appropriate grade for an access road and maneuvering area in front of the tunnel entrance. Tailings from tunnel excavations were used as fill for the road and terrace, and gunite was pressure-sprayed over the ridge cuts at each tunnel entrance to stabilize the rock face. Much of the components of BCN-409 are still recognizable; while the tunnel entrances have been sealed, the access road and terrace features and the piles of tailings that form the faces of the terrace are intact. Military use of Ka‘ena Point declined after World War II, with use primarily consisting of small-size maneuvers.

The Ka‘ena Passing Light, operated and maintained by the U.S. Coast Guard, was constructed at Ka‘ena Point in 1920. Initially consisting of a sixty-five foot tall concrete tower, the light was replaced in 1990 by a new beacon on a thirty-foot steel pole. The old light tower, a historic structure, was toppled and lies in the sand at Ka‘ena Point, north of the new beacon.

After the railway closed, a rough track followed the rail grade. A nine-mile dirt road was constructed around the point from 1954-1956, using prison labor. In 1971, the State Department of Transportation developed plans for a two-lane paved road around Ka‘ena Point. Due to significant opposition from the public, the concept was shelved and efforts shifted towards protection of this area. During the 1970s, the State began to purchase lands in the area for a proposed Ka‘ena Point State Park. In 1978, a Ka‘ena Point State Park Conceptual Plan was completed. In 1984, a portion of Ka‘ena Point Military Reservation was declared excess property and deeded to the State for park purposes.

Ka‘ena Point NAR was established in 1983, composed of twelve acres on the leeward side of the point. In 1986, an additional twenty-two acres on the windward side were added to the NAR. Degradation by off-road vehicle use was significant, and the primary management for the new NAR was to close the area to motorized vehicles. Erosion of the roadbed on the Wai‘anae side of the point prevented vehicular entry, and a boulder barricade was erected for this purpose on the Mokulē‘ia side. The results of prohibiting vehicles are positive and noticeable, with the regeneration of native coastal plant communities and the re-establishment of breeding populations of seabirds.

Visual Resources

The remote undeveloped nature of Ka‘ena provides stunning views of coastal sand dunes, cliff faces, the natural shoreline, and the ocean. Ka‘ena Point is unique in that one has views of both the Wai‘anae coast and the Mokulē‘ia coast from one vantage point. The Wai‘anae Sustainable Communities Plan (2000) identifies the protection of scenic views as a priority, including the green valleys, steep walled ridges and mountains, and the ocean, but makes no specific mention of Ka‘ena. The North Shore Sustainable Communities Plan (2000) identifies the preservation of scenic views as a priority, while generally identifying coastal cliffs, the coastline, and the Pacific Ocean as scenic views to be preserved. The plan specifically identifies stationary views from the shoreline between Ka‘ena Point and Makaleha Beach as views to be preserved.

From Ka‘ena Point, looking towards Wai‘anae, the view extends seven miles towards Mākaha to Kepuhi Point. Kea‘au Beach Park, Mākua Valley and Mākua Beach, and Keawa‘ula (Yokohama Beach) can all be observed, along with views of the Wai‘anae mountains. From Ka‘ena Point, looking towards Mokulē‘ia, the view includes much of the north shore coast, and part of the Ko‘olau mountains can be observed to the north, sloping towards Waimea.

V. ALTERNATIVES CONSIDERED

Two project alternatives are described: the construction of predator-proof fencing followed by removal of all predators from within the fenced unit (preferred alternative); and conservation management without the fencing (status quo, or the no-action alternative).

Alternative #1: Construct predator-proof fence, followed by feral predator eradication, to create a pest-free protected area on Ka‘ena Point peninsula (preferred alternative)

The preferred alternative is to construct a predator-proof fence, followed by aggressive predator control, to create a protected area at Ka‘ena Point. The construction of the fencing will make it possible for Ka‘ena Point to become a predator-free nesting area for seabirds. Since closing the point to motorized vehicles, numbers of nesting Laysan albatrosses and wedge-tailed shearwaters

have increased dramatically. Other species of seabirds may begin to nest at Ka‘ena in the future, if a safe haven is created. Rare native plants may also benefit with the removal of rats and mice, as their seeds will be safe from rodent predation. Biologically, eradication of predators is anticipated to provide greater conservation benefit than the existing program of ongoing control. From a cost perspective, while construction of predator-proof fencing has significant up-front costs, over the long-term the costs of fencing with predator control at the sea-ends is estimated to be less than the cost of the existing predator control program throughout the Reserve. The fencing is also anticipated to have a public education component. As Ka‘ena Point is accessible and highly visited by tourists and residents, the predator-proof fence may act as a demonstration project that increases overall appreciation for the natural resources protected by the fencing and improves understanding of conservation management.

Alternative #2. No action.

The no-action alternative is the status quo – continued predator control without fencing. This alternative fails to take advantage of existing funding opportunities to construct a predator-proof fence at Ka‘ena Point and requires sustained predator control actions. Moreover, despite the current predator control program, seabird predation by dogs, cats, and other mammals is still a significant problem. Under the no-action alternative, seabird populations are not anticipated to increase significantly, additional seabird species are not anticipated to be attracted to the area to breed, and native plants will continue to be impacted by seed predation by rodents. Over the long-term, the no-action alternative does not provide the same benefits to native species and contributes less to the long-term conservation needs of these species.

Further, when evaluated over time, the no-action alternative is projected to cost more. For this assessment, costs of the fencing alternative include the initial costs of fence construction and pest eradication, shown above, the annual costs of fence inspection and maintenance (estimated at 5% of capital fence cost), and the annual cost of managing a pest buffer zone at the sea ends of the fence (estimated at 30% of current annual pest control). The fence lifespan is estimated to be 25 years, with full fence replacement included every 25 years. Ongoing pest management for the no-fence alternative is estimated at $32,000 per year.

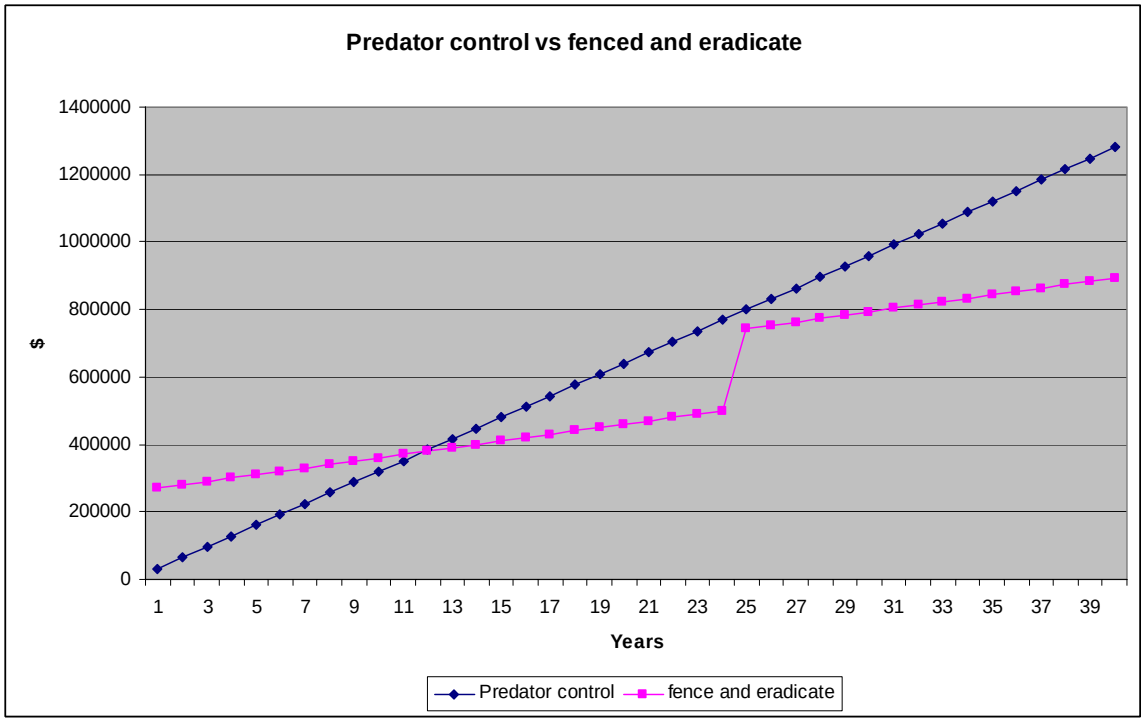

Figure 6. Cost comparison of preferred alternative (eradication) with the no-action alternative (control).

VI. ANTICIPATED IMPACTS OF THE PREFERRED ALTERNATIVE AND PROPOSED MITIGATION MEASURES

Vegetation: Construction of fencing would result in the disturbance and destruction of limited amounts of alien vegetation within a fencing corridor up to fifteen feet wide as a result of the minimal clearing and grading needed to facilitate construction. The fence corridor outside the roadbed has been preliminarily surveyed for endangered plants and the final alignment will be surveyed again to ensure all areas with sensitive biological resources will be avoided.

Rare species protocols will be implemented to avoid impact to any rare plant species (e.g., *Chamaesyce* or *Cyperus*) that may be located in or near the fence corridor. Specifically, in addition to the plant survey to be conducted in advance of construction, any rare plants found will be flagged and a buffer zone of at least 15 feet will be maintained from the plants. In addition, DOFAW will provide a botanist on-site before construction to review the locations of rare plants and discuss protocols with the fence crew to prevent unintentional harm to any rare plant in the fence corridor.

It is anticipated that the benefit to both listed and non-listed native coastal plants provided by the protection from rodents will more than compensate for any unavoidable damage caused during construction.

Alien species: The disturbance to the ground surface and vegetation involved with fence construction may create conditions suitable for the establishment of weedy plants, and workers, their equipment, and the fence materials could be agents for the unintentional introduction of invasive species. The following practices will be implemented to minimize the introduction of alien plants and insects and to reduce the possibility of establishment. First, boots, equipment and materials will be inspected for seeds, eggs, larvae, etc., prior to delivery and/or entry into the project area, and cleaned as necessary. Any heavy equipment used during construction will be inspected and cleaned as needed, following appropriate alien species prevention protocol recommended by DOFAW and USFWS. All construction workers will be instructed on specific procedures to prevent the spread or introduction of noxious alien plants in the project area. In addition, precautions will be taken to prevent spreading alien plants already found in the project area, and all food, refuse, tools, gear, and construction scrap will be removed upon completion of work.

Immediately after fence completion, alien mammals within the fenced unit would essentially be penned in. This could result in a short period of amplified damage to listed species. However, due to the relatively small size and open nature of Ka‘ena, it is unlikely that large predators, such as dogs, would be trapped within the completed fence. Any cats or mongoose trapped inside would have a limited impact on plants since they are not herbivorous, and timing construction to avoid nesting season should minimize impact on nesting seabirds. Moreover, due to the placement of the hood on the outside, climbing predators cannot get into the fenced area, but could get out if their home range is disrupted by the fencing. Rats and mice would likely be trapped inside, but due to their small home ranges, it is unlikely that the fencing will trap in many rodents that would normally have been outside the fence or exclude many rodents that would have tried to get out. Under the circumstances, no significant increase in the density of pest species is anticipated.

Native birds: Noise and activities associated with the construction of fencing may temporarily disrupt the activities of seabirds nesting within the NAR. Fence construction will be timed for October-early November or July-August. These time periods will avoid the Laysan albatross nesting season (November through June) and avoid the initial nesting period (April through June) and the primary fledging periods (September through October) for wedge-tailed shearwaters. Construction activities are likely to cause some seabird disturbance. Because wedge-tailed shearwaters typically takeoff before dawn, and return to the colony at dusk, the chance that any bird will be impacted by construction activities during takeoff or landing remote.

After construction, the presence of the fencing is considered unlikely to disorient seabirds. The fencing alignment has specifically been selected based on information from ongoing research on Laysan albatross to maintain a significant buffer zone from nest sites identified during past breeding seasons.

In addition, the alignment was selected so that the fence is sufficiently distant from bird use areas to minimize any opportunity for collisions on takeoffs or landings. Monitoring is planned to ensure that disruption to seabirds is minimized during fencing activities. If necessary, the top portion of the fence could be colored in such a way as to make it more visible to seabirds.

Based on existing information about nesting habits of Laysan albatross and wedge-tailed shearwaters, it is highly unlikely that any bird will actually be nesting within the project area, which is largely rocky, but activities will cease in the event of such activity and consultation with appropriate agencies will occur to determine the appropriate course of action to minimize impact to the birds.

The primary motivation for this project is to create the first “predator-free” area in the State and allow for expansion of native species populations. Over time, this action facilitates the recovery of the ecosystem to its original condition (a condition without non-native predators) and provides an opportunity for visitors to experience the type of natural ecosystem found in the Northwestern Hawaiian islands. The short-term disruptions due to construction are expected to be generously offset by the anticipated long-term benefits provided by the removal of predators, from dogs to rodents.

Monk seal: Because monk seal haul-out locations are over 500 meters from the proposed fencing corridor, construction is not anticipated to affect them. In addition, predator control activities planned for after the completion of the fencing, which are similar in nature to existing predator control actions, are also not anticipated to disturb the seals in any way. Proposed conservation activities are likely to benefit monk seals, by removing predators that act as carriers of diseases identified as threats to monk seal survival.

Archaeological Sites or Cultural Resources: In general, construction of the fencing primarily on top of the existing gravel road (constructed in the 1940s for military purposes) minimizes the impact to archaeological resources in the project area. This road provides a level, previously-disturbed foundation for the fence and its position on the slope of the ridge avoids the sand dunes and sandy soils in which subsurface cultural deposits and burials are a high probability. Construction and use of the road from 1943 to 1945 would have destroyed other sites or features associated within preceding periods or uses, and this corridor avoids cultural sites such as fishing shrines or heiau previously documented at Ka‘ena.

Construction of the fencing may, however, have an impact on the following cultural or historic features: Leina a ka ‘Uhane (Soul’s Leap), the OR&L Railway bed and associated features, and the Battery Construction No. 409 (BCN-409).

Leina a ka ‘Uhane (Soul’s Leap) is located near the northern end of the gravel road where the road turns east. While the formation itself can easily be avoided by the fencing, the precise location of the fencing in relation to the formation and the proximity of the fencing to this traditional cultural property may affect cultural beliefs and practices associated with Leina a ka ‘Uhane. Some stakeholders have indicated that having the Leina a ka ‘Uhane (Soul’s Leap) within the fenced unit would prevent souls from coming down from the mountain and leaping off into the next world, while other stakeholders have indicated that the fence would not be a problem because souls can move easily through barriers. Under either fencing alignment, the fence would have a visual impact on this cultural feature due to proximity. While visual and cultural effects will be avoided to the extent possible, they cannot be eliminated if the fence is constructed.

The fencing must cross the OR&L Railway bed at the northern and southern ends. At both ends, sections of the railway bed were found during field inspections that can be crossed without altering any of the character-defining features constructed to create the desired grade of the bed (e.g., raised railway bed, trenches, stone retaining walls) or any of the segments with paving slabs. Crossing at these areas would minimize the effect of the fence on the historic integrity of the railway bed and its associated features. On the southern end, the fence would need to breach a low stone wall which parallels the railway bed. The length of the wall and its location make it impossible to avoid. The breach would, however, remove only one relatively small section of the wall, and not a segment that is particularly unique or exemplary. To mitigate the impact of the fencing, the wall will be mapped and photographed, to allow restoration if the fencing is ever removed.

The selected fence alignment is on top of a gravel road that is itself a historic property, as it is over 50 years old and part of the BCN-409 complex. The road itself is not particularly unique or exemplary nor is it a key feature of the BCN-409 complex. The fence is not anticipated to irreparably alter the integrity of this complex as the installation will not disturb the complex’s significant components (e.g., the tunnel entrances, gunnite-coated facings, terrace retaining walls). In addition, construction requires minimal grading and so will not alter the fundamental formation or foundation of the road, which is made of excavated fill and tailings. Road sections will be documented as a form of mitigation, and the manner of fence installation will allow the road’s general appearance to be readily restored if the fence is removed at some point in the future.

Ka‘ena Point itself also has great cultural significance, apart from the individual cultural sites. During the previous public discussions on the concept of a road connecting the North Shore to the Wai‘anae coast through Ka‘ena, it is clear that many Native Hawaiians value the area and would consider any major changes or developments, such as a road, to be a sign of disrespect for the place.

As a result, there are likely to be some who believe that the proposed fence will have a negative impact on the cultural landscape.

At the same time, the purpose of the project is to allow the eradication of feral predators and assist in the preservation and long-term restoration of Ka‘ena Point and the unique natural resources found therein. To some stakeholders, natural resources are cultural resources, and a project designed to enhance seabird and native plant populations, without limiting public access, has a positive impact on cultural resources.

Based on a review of the circumstances, including the distance from the dune area likely to contain cultural deposits, the disturbed condition of the railway and the military road, the limited permanent impact of the fencing on the remaining historic features, the anticipated benefit to natural resources, the importance of these resources from a cultural perspective, the continuation of public access into the area, and the ability to modify the fencing alignment to minimize the impact on cultural features, the proposed action is not expected significantly impact archaeological or historic sites or significantly impact Native Hawaiian traditional and cultural practices.

A section 106 consultation has been initiated by the USFWS with SHPD for this project because of the Federal funding. Any mitigation requirements resulting from the section 106 consultation will be incorporated into the project and implemented before or during construction, as appropriate.

While archaeological features or cultural sites are not anticipated to be significantly impacted by the proposed action, should evidence of any archaeological or cultural properties be encountered during construction, vegetation clearing and fence construction would immediately cease and the appropriate parties would be consulted immediately. If necessary, the fence alignment will be adjusted to reduce or eliminate impact to any features located during surveys or construction or as recommended during Section 106 consultation to be conducted for this project.

Viewplanes: The remote, undeveloped nature of Ka‘ena Point, with views of the cliffs, coastal sand dunes, the natural shoreline, and the ocean, is one of the primary attractions to those visiting the areas. The planned fence alignment and design is designed for minimal interference with the ocean and shoreline views. The marine grade mesh used in the fencing is painted carraca green at the factory, and field tests by the manufacturer have determined that this color blends best into a diverse range of landscapes. In addition, the green fence is less reflective than traditional stainless steel fences, making it less visible from the ocean.

Coming from the Mokulē‘ia side, the fence alignment is largely hidden behind the existing boulder barricade that prevents vehicular access to the point. As

one crosses the boulder barricade into the core of Ka‘ena Point NAR, the fencing will interfere with the spectacular views of the point, sky, and sea that lie in front for only a short distance until one reaches the fencing. Once one passes through the double-door system, the impact of the fence on the scenic vista looking towards the Point and the Lighthouse will cease.

As one reaches the point and turns back to view the land, the fence will be visible, but should not interfere with the eye’s focus on the cliffs that tower above, dwarfing the fence. The fence, some six feet tall, will lie almost ½ mile inland at its greatest distance from the point, nearer the base of the cliffs. There is an existing white sign approximately four feet high within the fence corridor that is largely invisible from the point. Based on the difficulty of picking out this white sign and the photo simulations (below), it is anticipated that the visual impact of a green mesh fence two feet higher will be minimal. The fencing is anticipated to blend into the background due to the color and the ability to see through mesh.

Coming from the Wai‘anae side, the fence alignment is largely hidden by the topography and curves of the cliff. After crossing the existing washout, the fencing will obstruct views of the point for only a short distance until one reaches the fencing. Once one passes through the double-door system, the impact of the fence on the scenic vista looking towards the Point and the Lighthouse will cease.

Digital simulations from 3 perspectives were developed for the project by Turner & deVries, Ltd. to illustrate the anticipated impact of the fencing on the viewplanes. The first view is from the boulder barricade on the Mokulē‘ia side, looking towards the point. The second view is from just after the washout on the Wai‘anae side, looking towards the point. The third view is from the point, looking back towards the mountains.

Figure 7. Simulation of fencing (Alignment Option 2), Mokulē‘ia side, view towards Ka‘ena Point.

Figure 8. Simulation of fencing, Wai‘anae side, view towards Ka‘ena Point.

Figure 9. Simulation of fencing, view from Ka‘ena Point.

While some interference with the scenic vistas at Ka‘ena Point may be unavoidable, the fence’s role in helping to improve the wild and natural, predator-free character of the point is anticipated to outweigh these impacts. Additional consultation with appropriate agencies and groups will occur to minimize the visual impact of the fence upon cultural features at the point, such as Leina a ka ‘Uhane.

Public access: Public access is not anticipated to change significantly due to the construction of predator-proof fencing. Access doors are to be incorporated at locations where the fencing crosses the primary trails into and out of the Point from the Mokulē‘ia and Wai‘anae sides. Access for those approaching the fence from other locations will be maintained as these individuals can easily follow the fence alignment to one of the doors; access along the shoreline is not anticipated to be affected as the fencing will stop at or before the high tide line. The double-door system will be constructed with the same quality and design as the rest of the fence and will be large enough that up to nine people may enter together or so that a person can enter with a bicycle or fishing pole. As a result, the impacts on public access are not anticipated to be significant.

Soil and water: Short term soil disturbance is unavoidable, but no lasting changes to normal patterns of runoff or percolation are expected. To minimize the potential for erosion, at locations along the fenceline where natural drainage channels exist or where surface water is likely to collect, the ground will be

prepared to move water away from the fencing. All ground preparation will be consistent with the normal runoff pattern of the roadbed, where stormwater runs off to the sides of the road. Best Management Practices will also be incorporated into the project to minimize the potential for soil erosion and include planning the construction phasing to reduce exposed ground areas, minimizing the length and steepness of disturbed areas, and avoiding earthwork during inclement weather. Due to the methods of fence construction planned, the underlying soil characteristics, the lack of streams, and the generally arid nature of the project area, no noticeable impacts are expected.

Air pollution: Limited air pollution from vehicles, equipment, and small power tools will be unavoidable during fence construction. Use of this equipment is temporary and is not anticipated to have a significantly negative contribution to the overall air quality in the region. Fugitive dust may be created on the Wai‘anae side, when creating the fence platform on the loose soils contouring down the hill. Best Management Practices will be incorporated into the project to minimize the impact of fugitive dust as needed. Given the remote location of the project site and the narrow width of the fencing corridor to be disturbed, the impacts of fugitive dust are not anticipated to be significant.

Air traffic: FAA Advisory Circular 150/5200-33A (“Hazardous Wildlife Attractants On or Near Airports”) recommends certain minimum separation criteria for land-use practices that attract hazardous wildlife to the vicinity of airports, including a recommendation of five statute miles between the farthest edge of the airport’s area of operations and the hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach or departure space. The construction of fencing designed to protect nesting seabirds and encourage increases in populations could be perceived to fall within this advisory circular, as the fencing is just less than five miles from the edge of Dillingham Airfield. Dillingham Airfield is a general aviation joint-use facility limited to daytime operations by small single-engine and light twin-engine aircraft, sailplanes, ultra-light aircraft, and helicopters. Because this type of air traffic at Dillingham utilizes a distance shorter than five miles for approach and departure patterns, it is unlikely that the proposed fencing will cause hazardous wildlife movement into or across the approach or departure space used. Moreover, the fencing could be considered to reduce the risk of bird strikes, by enticing birds nesting at sites closer to Dillingham to move to Ka‘ena Point.

Social impacts: Periodic noise from potential helicopter flights, power tools, and other activity associated with fence building will be unavoidable during the construction period. In addition, there will be short-term impacts associated with temporary closures of portions of the NAR (area under construction) for safety purposes. Any closures that impact the ability of the public to access the interior of Ka‘ena Point will be publicized in advance and will be limited in duration and location only to the extent necessary for public safety. Due to the

remote nature of the project area, the temporary nature of any closures, and the planned concurrent educational outreach efforts explaining the purpose of the fencing, negative social impacts resulting from the project are not anticipated to be significant.

Economic Impacts: The proposed action involves the expenditures of funds necessary to construct the fencing, including the purchase of fencing materials, the hiring or contracting of crews, and the purchase or rental of equipment including helicopters, and, after fence construction, to remove predators from within the fenced unit. Current funding for the project includes funds provided by the U.S. Fish and Wildlife Service and the State.

The project is not expected to have any major negative economic impacts. Positive economic impacts will result from the release of project funds into the State economy and the opportunities for training in the methods for building predator-proof fences. The proposed action may attract additional funding for habitat restoration, predator control, research, or monitoring activities because of the presence of a predator-proof fence.

VII. ANTICIPATED DETERMINATION

It is not expected that this project will have a significant negative impact on the environment, and a Finding of No Significant Impact is anticipated.

VIII. FINDINGS AND REASONS SUPPORTING ANTICIPATED DETERMINATION

The goal of the proposed action is to create a predator-free environment on 59 acres at Ka‘ena Point through the use of predator-proof fencing and predator removal. The permanent removal of predators from the Ka‘ena Point peninsula is anticipated to provide a long-term benefit to nesting seabirds and to native plants. Without fencing, sustained predator control efforts must continue in order to maintain the status quo of low levels of predators, and predation by feral animals on nesting seabirds and native vegetation will remain a significant problem.

The anticipated Finding of No Significant Impact is based on the evaluation of the project in relation to the following criteria identified in the Hawai‘i Administrative Rules §11-200-12:

1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resource.

The proposed action does not involve an irrevocable commitment to loss or destruction of any natural or cultural resource. Instead, the goal of the proposed

action is to benefit the natural environment by facilitating the eradication of predators from Ka‘ena Point, important habitat for seabirds and rare plants.

2) Curtails the range of beneficial uses of the environment.

The proposed action will not curtail beneficial uses of the environment. Instead, the project will enhance protection of important habitat for nesting seabirds by facilitating the removal of a range of non-native predators. Public access will not be impacted, and public appreciation of the natural resources supported at Ka‘ena Point is likely to increase.

3) Conflicts with the state’s long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.

The proposed action is consistent with the environmental policies established in Chapter 344, Hawai‘i Revised Statutes (HRS) and contributes to the conservation of threatened and endangered species, as covered by Chapter 195D, HRS. It is also consistent with Section 3 of the City and County of Honolulu General Plan (1992), which sets goals and policies for maintaining O‘ahu’s natural environment, and with Chapter 3 of both the North Shore and Wai‘anae Sustainable Communities Plans, which concerns land use policies, principles, and guidelines. Finally, protection of habitat at Ka‘ena Point implements the Hawai‘i Comprehensive Wildlife Conservation Strategy (2005), the USFWS Recovery Plans for O‘ahu Plants (1998), the Multi-Island Plants (1999), the Maui Plant Cluster (1997), and for *Panicum fauriei* var. *carteri* (1993), the North American Waterbird Conservation Plan (2002), and the USFWS Regional Seabird Conservation Plan (2005). In addition, both Laysan albatrosses and wedge-tailed shearwaters are federally protected under the Migratory Bird Treaty Act of 1918.

4) Substantially affects the economic or social welfare of the community or state.

The proposed action will not adversely affect the economic or social welfare of the community or state. The ecosystem-related goals of the project will directly benefit the economic, cultural, educational, and social interests of the community and the State by helping to facilitate the continued restoration of the natural environment at Ka‘ena Point.

5) Substantially affects public health.

The proposed action is not anticipated to substantially affect public health. The proposed action may have a positive impact on public health by protecting coastal habitat, thus encouraging more people to hike and appreciate the natural resources of the area.

6) Involves substantial secondary impacts, such as population changes or effects on public facilities.

The proposed action is not anticipated to result in any substantial secondary impacts, such as population changes or effects on public facilities. The proposed action does not involve any changes in population, as no people reside at Ka‘ena Point, and the only public facility within the project area, a U.S. Coast Guard Aid to Navigation, will not be impacted by the project.

7) Involves a substantial degradation of environmental quality.

The proposed action does not involve a substantial degradation of environmental quality. Instead, environmental quality is anticipated to improve with the implementation of the proposed action. Construction of predator-proof fencing, followed by aggressive predator control, will enhance environmental quality of the project area by improving the quality of protected nesting seabird and rare plant habitat.

8) Is individually limited but cumulatively has considerable effect upon environment or involves a commitment for larger actions.

The proposed action involves the construction of predator-proof fencing at Ka‘ena Point. The proposed fencing is anticipated to have only cumulatively beneficial effects upon the environment, and does not involve a commitment for larger actions, other than ongoing fence maintenance and predator control.

9) Substantially affects a rare, threatened or endangered species, or its habitat.

There are no known rare, threatened, or endangered plants within the planned fencing corridor; however, globally rare seabirds and several species of rare native plants will benefit from the protection this fencing will provide from non-native predators. Exclusion of dogs, cats, mongooses, rats, and mice will provide significant protection to the ground-nesting seabirds that utilize Ka‘ena Point. Predator proof fencing should significantly reduce the number of seabirds killed each year by small mammals and encourage an increase in the breeding population. Native plants are also anticipated to benefit from the removal of seed-eating rodents. Thus, it is not anticipated that the project will negatively affect a rare, threatened or endangered species.

10) Detrimentally affects air or water quality or ambient noise levels.

The proposed action will have no detrimental effects on air quality, water quality, or noise levels. The area is remote, and construction noise and air quality impacts are expected to be localized and temporary.

11) Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.

The project area is located on the coastal peninsula of Ka‘ena Point. There is the possibility that portions of the fencing could be damaged by extreme surf conditions, storms, tsunami, or coastal erosion. Previous experiences in New Zealand indicate that these fences can withstand winds up to 180 km/hr (over 100 mi/hr). The value of predator-proof fencing that enhances seabird survival and promotes habitat restoration for rare plants and seabirds rates outweighs the potential costs associated with loss of fencing due to damage. The planned fencing has a lifespan of approximately 25 years, and it is anticipated that the benefits of the fencing and predator removal will be visible almost immediately. The proposed action will not damage or adversely affect any environmentally sensitive areas.

12) Substantially affects scenic vistas and view planes identified in county or state plans or studies.

The North Shore Sustainable Communities Plan (2000) identifies the preservation of scenic views as a priority, while generally identifying coastal cliffs, the coastline, and the Pacific Ocean as scenic views to be preserved. The plan specifically identifies stationary views from the shoreline between Ka‘ena Point and Makaleha Beach as views to be preserved. The Wai‘anae Sustainable Communities Plan (2000) also identifies the protection of scenic views as a priority but, while mentioning several significant stationary views, makes no mention of Ka‘ena.

The proposed action will not affect the viewplane from any existing roadway or residential area. However, the proposed fencing may affect the scenic vista for visitors to Ka‘ena Point. The planned fencing corridor utilizes topography to minimize views of the fencing to hikers as they approach Ka‘ena Point from either the Wai‘anae side or the Mokulē‘ia side and as they look backwards from the Point. The fence will be visible for a short period as visitors approach it after crossing the boulder barricade on the Mokulē‘ia side and for a short period after visitors round the edge of the hill past the washout on the Wai‘anae side. When looking mauka from the Point, the fence will be visible but is anticipated to be largely inconspicuous against the cliffs. The fence, some six feet tall, will lie almost ½ mile inland at its greatest distance from the Point, nearer the base of the 1,000 foot tall cliffs. While the proposed action may have some impact on the scenic views at Ka‘ena Point, because of the placement of the fencing, it is not expected that scenic vistas will be substantially affected.

13) Requires substantial energy consumption.

The proposed action does not require substantial energy consumption, but instead will consume small amounts of energy during fence construction through the use of small power tools and transportation of materials and crews.

IX. LIST OF PERMITS REQUIRED FOR PROJECT

Construction of the project is anticipated to require the following approvals and permits:

Permit	Issuing/Approving Agency
Special Management Area Use Permit - Major	City and County of Honolulu, Department of Planning and Permitting (DPP)
Shoreline Setback Variance	DPP
Shoreline Certification Application	State Department of Land and Natural Resources, Land Division

Based on conversations with staff from the DLNR Office of Conservation and Coastal Lands, a new Conservation District Use Application will not be required for this project. Instead, the project is permitted under existing CDUA No. SH-2/26/82-1459, associated with the creation of the Natural Area Reserve.

X. ENVIRONMENTAL ASSESSMENT PREPARATION INFORMATION

This Environmental Assessment was prepared by:

Division of Forestry and Wildlife
Department of Land and Natural Resources
State of Hawai‘i
1151 Punchbowl St., Ste. 325
Honolulu, HI 96813
Tel: (808) 587-0166; Fax: (808) 587-0064

XI. REFERENCES

Arrigoni, Edward. *A Nature Walk to Ka‘ena, O‘ahu.* 1977. University of Hawai‘i: Sea Grant, Marine Advisory Program. Honolulu, Hawaii.

Bath, J. and N. Napoka. 1988. *Ka‘ena Complex (State Site No. 50-80-03-1183).* National Register of Historic Places Registration Form. Prepared for State of Hawai‘i, Department of Land and Natural Resources, Historic Sites Section.

Beyer, D. Hunter, and F. Martin. 2003. *Permacopia, Book 1: Plants of the Ahupua‘a. Endemic, Indigenous, & Polynesian Species of Hawai‘i.* Volcano, Hawaii.

City and County of Honolulu, Department of Planning and Permitting. 1992. *O‘ahu General Plan*. Honolulu, HI. Available at: http://www.honoluludpp.org/Planning/OahuGenPlan.asp.

City and County of Honolulu, Department of Planning and Permitting. 2000. *North Shore Sustainable Communities Plan*. Honolulu, HI. Available at: http://www.honoluludpp.org/Planning/DevSust_NorthShore.asp.

City and County of Honolulu, Department of Planning and Permitting. 2000. *Wai‘anae Sustainable Communities Plan*. Honolulu, HI. Available at: http://www.honoluludpp.org/Planning/DevSust_Waianae.asp.

Eijzenga, Jaap. 2007. email communications re: Ka‘ena point count Saturday morning confirmation.

Handy, E.S. and Elizabeth Green Handy. 1972. *Native Planters in Old Hawaii: Their Life, Lore, and Environment.* Bishop Museum Press: Honolulu.

Hawai‘i Audubon Society. 2002. *Bird of the Month: Laysan Albatross (Phoebastria immutabilis) or Mōlī*. ‘Elepaio 62 (2): 102.

Hawai‘i Audubon Society. 2005. *Hawai‘i’s Birds*. Island Heritage Press: Waipahu, HI.

Hawai‘i Revised Statutes, HRS 195-1. 1985. Available at: http://www.capitol.hawaii.gov/hrscurrent/Vol03_Ch121-0200D/HRS0195-0001.htm.

Hearty, P.J. 2002. *The Ka‘ena Highstand of O‘ahu, Hawai‘i: Further Evidence of Antarctic Ice Collapse during the Middle Pleistocene*. Pacific Science 56 (1): 65-81.

Honolulu Advertiser. 1998. Leaders to discuss protecting Ka‘ena. September 29.

Honolulu Star-Bulletin. 2006. Dogs blamed in bird deaths. November 8.

Howald, Gregg, et al. 2007. *Invasive Rodent Eradication on Islands.* Conservation Biology, vol. 21, no. 5, 1258-1268.

Howarth, F.G. and W.P. Mull. 1992. *Hawaiian Insects and Their Kin*. University of Hawai‘i Press: Honolulu.

Kamakau, S.M. M.K. Pukui, trans.; D.B. Barrére, ed. 1964 (1870). *Ka Po‘e Kahiko*. Bishop Museum Special Publication 51. Bishop Museum Press: Honolulu.

Krauss, Beatrice H. 2001. *Plants in Hawaiian Medicine.* The Bess Press: Honolulu.

Kushlan, J.A., et al. 2002. *Waterbird Conservation for the Americas: The North American waterbird conservation plan, Version 1*. Waterbird Conservation for the Americas, Washington, DC. 78pp. Available at: www.waterbirdconservation.org.

Leone, Diane. 2007. *Feds Eye Protected Status for Black-footed Albatross.* Honolulu Star Bulletin. October 10, 2007. available on-line at http://starbulletin.com/2007/10/10/news/story06.html.

Lucas, Paul F. Nahoa. 2004. *No Ke Ola Pono O Ka Lāhui Hawai‘i: The Protection and Perpetuation of Customary and Traditional Rights as a Source of Well-Being for Native Hawaiians.* In Hūlili: Multidisciplinary Research on Hawaiian Well-Being. Vol. 1, No. 1. Kamehameha Schools.

Macdonald, G.A. and A.T. Abbott. 1970. *Volcanoes in the Sea: The Geology of Hawai‘i*. University of Hawai‘i Press: Honolulu.

McAllister, J.G. 1933. *Archaeology of O‘ahu*. Bishop Museum Bulletin 104. Bishop Museum Press: Honolulu.

McEldowney, H. 2007. *Summary of Known and Possible Historic Properties at Ka‘ena Point*. Prepared for State of Hawai‘i, Department of Land and Natural Resources, Division of State Parks/Division of Forestry and Wildlife. Honolulu, HI.

Mink, J.F. and S.L. Lau. 1990. *Aquifer Identification and Classification for O‘ahu: Groundwater Protection Strategy for Hawai‘i*. Technical Report #179. Prepared for State of Hawai‘i, Department of Health, Groundwater Protection Program. Honolulu, HI.

National Marine Fisheries Service. 2007. Recovery Plan for the Hawaiian Monk Seal (*Monachus schauinslandi*). Second revision. National Marine Fisheries Service, Silver Spring, MD. 165 pp.

Palmer, D.D. 2003. *Hawai‘i’s Ferns and Fern Allies*. University of Hawai‘i Press: Honolulu.

Pitt, William C. and G. Witmer. 2006. *Invasive Predators: a synthesis of the past, present, and future.* USDA National Wildlife Research Center – Staff Publications. University of Nebraska, Lincoln.

Pukui, M.K., S.H. Elbert, and E.T. Mookini. 1974. *Place Names of Hawai‘i*. University of Hawai‘i Press: Honolulu.

Pukui, M.K. and S.H. Elbert. 1986. *Hawaiian Dictionary*. University of Hawai‘i Press: Honolulu.

Sohmer, S.H. and R. Gustafson. 1987. *Plants and Flowers of Hawai‘i*. University of Hawai‘i Press: Honolulu.

Starr, F., K. Starr, and L. Loope. 2006. *Annotated checklist of the Vascular Plants on Midway Atoll, Hawaii. An addendum to the 1999 Botanical Survey of Midway Atoll.*

State of Hawai‘i, Department of Land and Natural Resources, Division of Forestry and Wildlife. 1996. *Best Management Practices for Maintaining Water Quality in Hawai‘i*. Honolulu, HI. Available at: http://www.state.hi.us/dlnr/dofaw/pubs/BMPs_bestmanagement.pdf.

State of Hawai‘i, Department of Land and Natural Resources. 2005. *Hawai‘i Comprehensive Wildlife Conservation Strategy*. Honolulu, HI. Available at: http://www.dofaw.net/cwcs/.

State of Hawai‘i, Department of Land and Natural Resources, Division of Forestry and Wildlife, Natural Area Reserves System. Undated. *Ka‘ena Point Natural Area Reserve Management Plan*. Honolulu, HI. Available at: http://www.dofaw.net/nars/files/Kaenaplan.doc.

State of Hawai‘i, Department of Land and Natural Resources, Division of State Parks. 1982. *Archaeological Field Inspection of the Historic Site (#1183) at Ka‘ena Point, Keawa‘ula, Ka‘ena Point State Park, O‘ahu*. Honolulu, HI.

State of Hawai‘i, Department of Transportation. 1987. *Report to the 14th Legislature, Regular Session of 1988, on S.R. 27, Requesting a State Standard Road Around Ka‘ena Point.* Honolulu, HI.

State of Hawai‘i, Office of State Planning, Land Use Division. 1991. *Subregional Land Use Plan: Mokulē‘ia to Ka‘ena*. Honolulu, HI.

Sterling, E.P. and C.C. Summers. 1978. *Sites of O‘ahu*. Bishop Museum Press: Honolulu.